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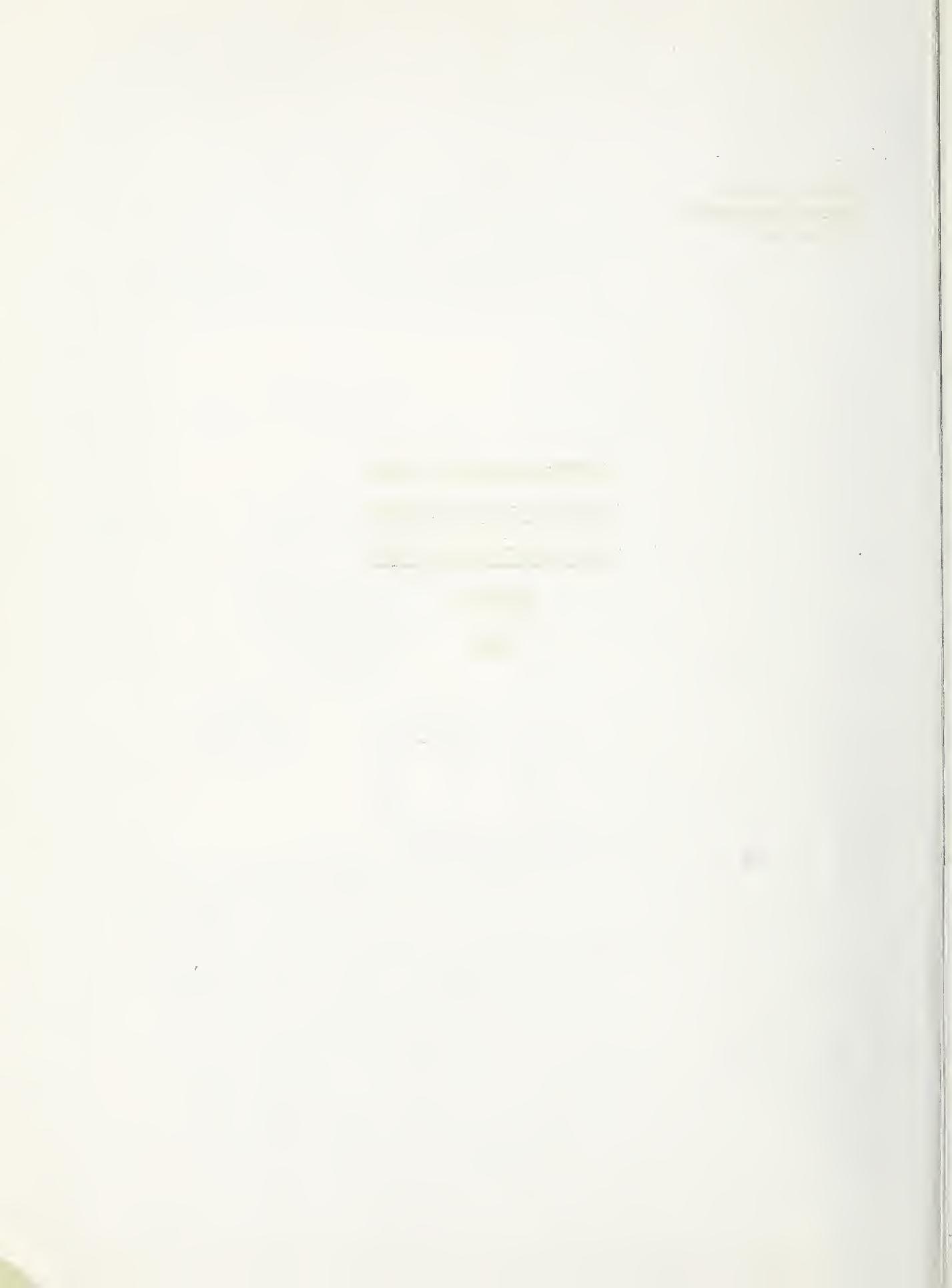


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S
PLANS - Helena
Timber Management
Region One

3
TIMBER MANAGEMENT PLAN,
LINCOLN WORKING CIRCLE,
HELENA NATIONAL FOREST,
MONTANA
Sc 1959





FOREST SERVICE

COPY

WASHINGTON, D. C.

965716

Region 1

January 30, 1959

Richard E. McArdle, Chief, By

S-PLANS, R-1, Timber Management, Lincoln Working Circle,
Helena National Forest

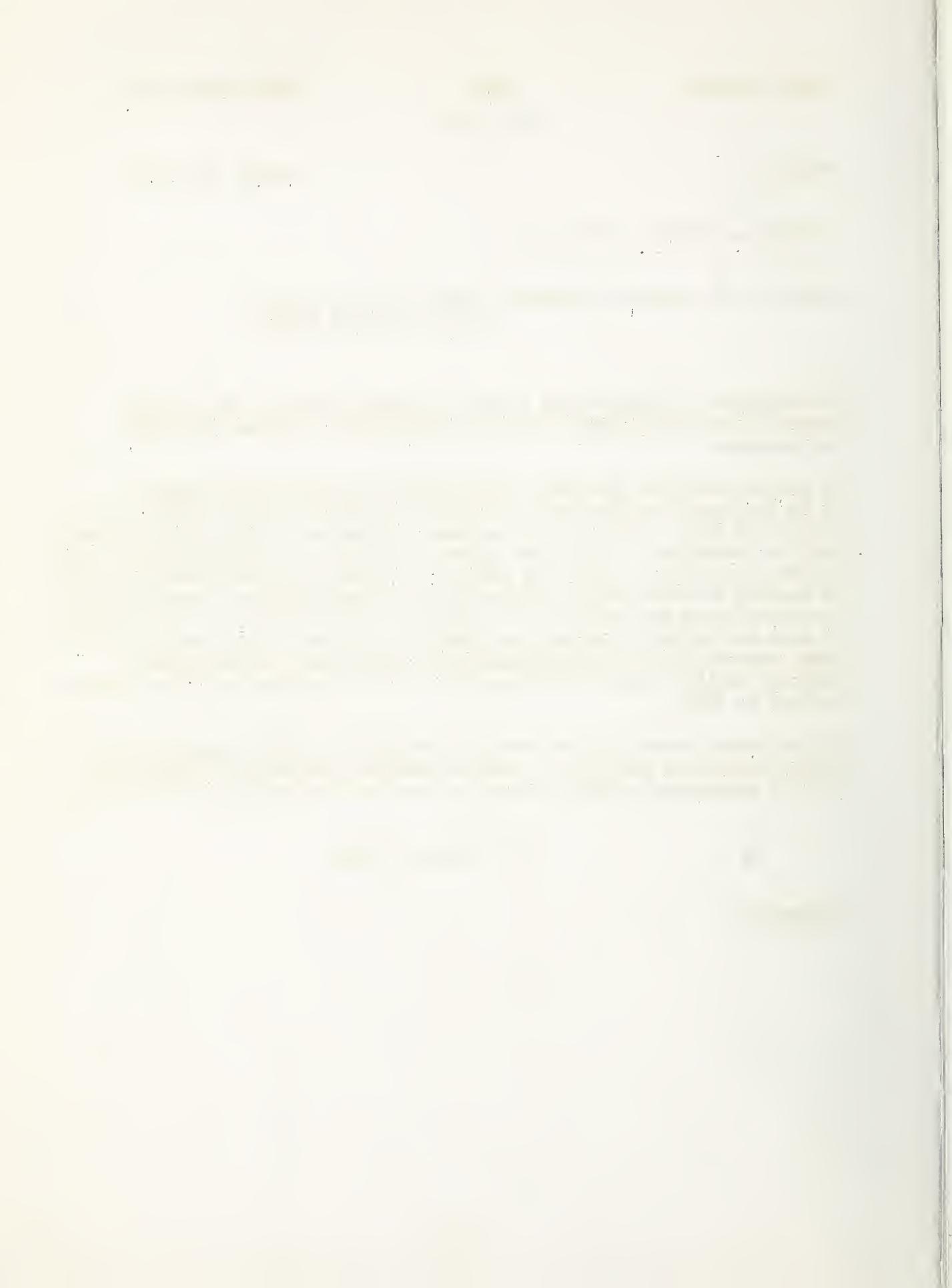
The approved original of the timber management plan for the Lincoln Working Circle, submitted with your memorandum of October 24, 1958, is returned.

In view of the good age class distribution on this working circle, it is disturbing to find that the plan provides for clear cutting at a rate which would result in cutting over the entire working circle in about half the rotation. I would not approve the plan with this provision in it except for the fact that it is very unlikely that full allowable cut will be reached on this working circle within the next decade. Also we understand that your application of the Kemp formula contemplates recalculation of area and volume to be cut each decade. This would have been a better plan, however, if it had contained more discussion of these points. Approval of this plan is contingent upon this being done when the plan is revised in 1967.

The enclosed review by Gross should be studied by those responsible for administration of the plan. A copy of Castles' and Gross' reviews and of this memorandum should be bound in the front of each copy of the plan.

/s/ EDWARD P. CLIFF

Enclosures



FOREST SERVICE

COPY

WASHINGTON, D. C.

The Record

January 23, 1959

L. S. Gross, Forester

S-PLANS, R-1, Timber Management, Lincoln Working Circle,
Helena National Forest

The management plan for the Lincoln Working Circle, submitted by R-1 with memorandum of October 24, 1958, is concerned with 375 M acres of commercial national-forest land. It includes all of the Lincoln Ranger District and part of the Helena Ranger District. The inventory shows a total volume of 3.3 billion feet; about 1/3 is sawtimber size material, 2/3 under sawtimber size. The chief forest types are Douglas-fir and lodgepole pine.

The calculated allowable annual cut is 20.2 MM board feet of sawtimber (54 board feet per acre) plus the equivalent of 31.8 MM board feet of other products (the equivalent of 85 board feet per acre).

The plan states that little cutting was done on this working circle prior to 1955 and that the working circle has very nearly the best age class structure of all the working circles in the region.

Market demands are not good in the Lincoln Working Circle. At present established mills utilize about 7 MM sawtimber annually; there appears to be little or no market for products other than sawtimber. Although control of cutting will be by volume, the authors predict that if the full allowable cut of sawtimber is moved the average area cut over annually will be 5,190 acres. This same acreage contains the calculated 31.8 MM feet of other products. If cutting proceeds at this rate the entire working circle will be cut over in less than 75 years.

Age classes were not mapped, but as stated on page 11, the age class structure was determined from sample plot data. In my opinion, the age class distribution on this working circle strongly indicates the desirability of using operable area allotment as the basis for regulating the cut. This was not done. The plan contains allowable cut calculations on a volume basis by using the Kemp formula and three others. The plan states that the results of application of the Kemp formula were used because these results were close to the average of all the calculations. It is a little difficult to follow through on all of the calculations. A brief summary table showing the results of each formula would have been desirable. On page 94, it appears that in using the Austrian formula a current growth rate of 20 cubic feet per acre per year was applied to 207 M acres. On page 95, when the Hanzlik formula was used it appears that the same 20 cubic feet per acre per year was applied only to 34 M acres. Apparently this accounts for the great difference between the Hanzlik calculation and the others.

In reviewing the mimeographed regional marking guides included in this plan, I was impressed by a seeming inconsistency. In the Douglas-fir guide, top of page 3, the sentence "Except on winter game ranges, favor spruce where site is adapted" may be garbled. I suspect that it was intended to say something to the effect that Douglas-fir regeneration is desired except on winter game ranges. On such areas adapted to Englemann spruce, efforts should be made to obtain spruce regeneration. I assume that this was intended on the grounds that Douglas-fir reproduction is far more palatable to big game than is Englemann spruce reproduction. If so, the statement should be clarified.

Range Management commented:

Page 23. Item (2) - 1st par. last 2 sentences.

Reads like we are planning on "mechanized cowboys" for good range management. This is rather a poor R. M. observation.

Item (2) - last par. Except for the most highly producing range sites (meadows, etc.) it appears a losing game to range over the long haul-- rightly so. Seems as though we should recognize this now specifically.

I recommend approval of the plan.

/s/ L. S. GROSS

FOREST SERVICE

COPY

MISSOULA, MONTANA

The Record

October 10, 1958

John R. Castles, Forester

/s/ John R. Castles

S - PLANS, Helena - Timber Management - Lincoln Working Circle

I have reviewed the timber management plan for the Lincoln Working Circle of the Helena National Forest.

This plan considers the area in the Helena National Forest lying essentially west of the Continental Divide on the headwaters of the Blackfoot and the Little Blackfoot Rivers.

The working circle encompasses 375,279 acres of national-forest nonreserved commercial forest land on a total gross national-forest area of 420,541 acres. On this is an estimated total sawtimber volume of 1,172,003 M board feet, Scribner. In addition, there are 4,338,000 cords of green material, five inches to 11 inches d. b. h. in size.

The inventory used in this plan meets the standards to which the present regional effort is directed. The total cubic volume estimate computes to a statistical accuracy of plus or minus five percent based on one probability.

An allowable cut of 20,199 M of sawtimber and 63,601 cords of material 5 inches to 11 inches d. b. h. has been recommended. A cut of 20,199 M of sawtimber amounts to about 1.72 percent of the total sawtimber volume. This appears to be reasonable in comparison to other cuts computed in the region.

The plan highlights several interesting points and problems of the area. Among the more important ones are the following:

1. Before full utilization can be obtained, an industry which will utilize small-sized material is needed. Apparently there is now sufficient headsaw capacity to utilize the sawtimber-sized material.
2. The completion of Highway No. 20 has opened this area to truck haul to marketing areas east of the Continental Divide. Until the highway was completed, little activity took place. Now it is possible to place the unit into production.
3. The working circle apparently has a relatively good age-class balance, and most stands have retained their vigor. However, after some travel through the area, it is obvious that there are

many overmature stands now suffering high mortality losses from insects and disease. Apparently fire has not been a serious problem during the past half century, but the extensive areas of uniform age classes attest to the fact that fire can be expected to be serious when weather conditions become adverse.

4. Access to overmature stands is the key to management in this area, as it is in most areas in the region. With a preponderance of timber volume in low-value or small sized species, orderly and timely development will be quite dependent upon the availability of Federal funds for mainhaul access roads.

I think there are at least two points that need some further comment:

1. In the discussion of allowable cuts on page 33*, it appears to be the intent of the forest to include the ponderosa pine type with the Douglas-fir because it is of a relatively minor amount. However, the table on page 34* indicates that the ponderosa pine type is treated separately. I agree with the forest that it is impracticable to regulate this minor volume of pine due to its location and occurrence.
2. This plan is an example of the results of the decentralized organization of timber management plan preparation in this region. In some cases through the plan, it may be noted that precise terminology and discussion might have been improved. However, the rangers and forest technicians who participated in preparing and writing the plan have demonstrated that they have given a lot of thought to it.

With the working circle just coming into production, this plan is very timely and should serve as a valuable guide until the next recommended revision in 1967.

I find that the forest has followed the prescribed outline and regional guidelines in preparing the plan. In my opinion, it is technically accurate and well conceived. Therefore, I recommend that this plan be approved by the region.

* Pages 20 and 21 in this reproduction

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TIMBER MANAGEMENT PLAN FOR THE LINCOLN WORKING CIRCLE

HELENA NATIONAL FOREST

REGION 1, MONTANA

1958

A. TITLE AND APPROVAL SHEET

Submitted by	<u>/s/ Carl L. Marsh, Forester</u>	Date	<u>April 20, 1958</u>
Approved by	<u>/s/ Vern Hamre</u> Forest Supervisor	Date	<u>9/29/58</u>
Approved by	<u>/s/ E. H. Juntunen</u> Act. R. F.	Date	<u>10/30/58</u>
Approved by	<u>/s/ Edward P. Cliff</u> <u>/s/ LSG</u> Acting Chief	Date	<u>1/30/59</u>

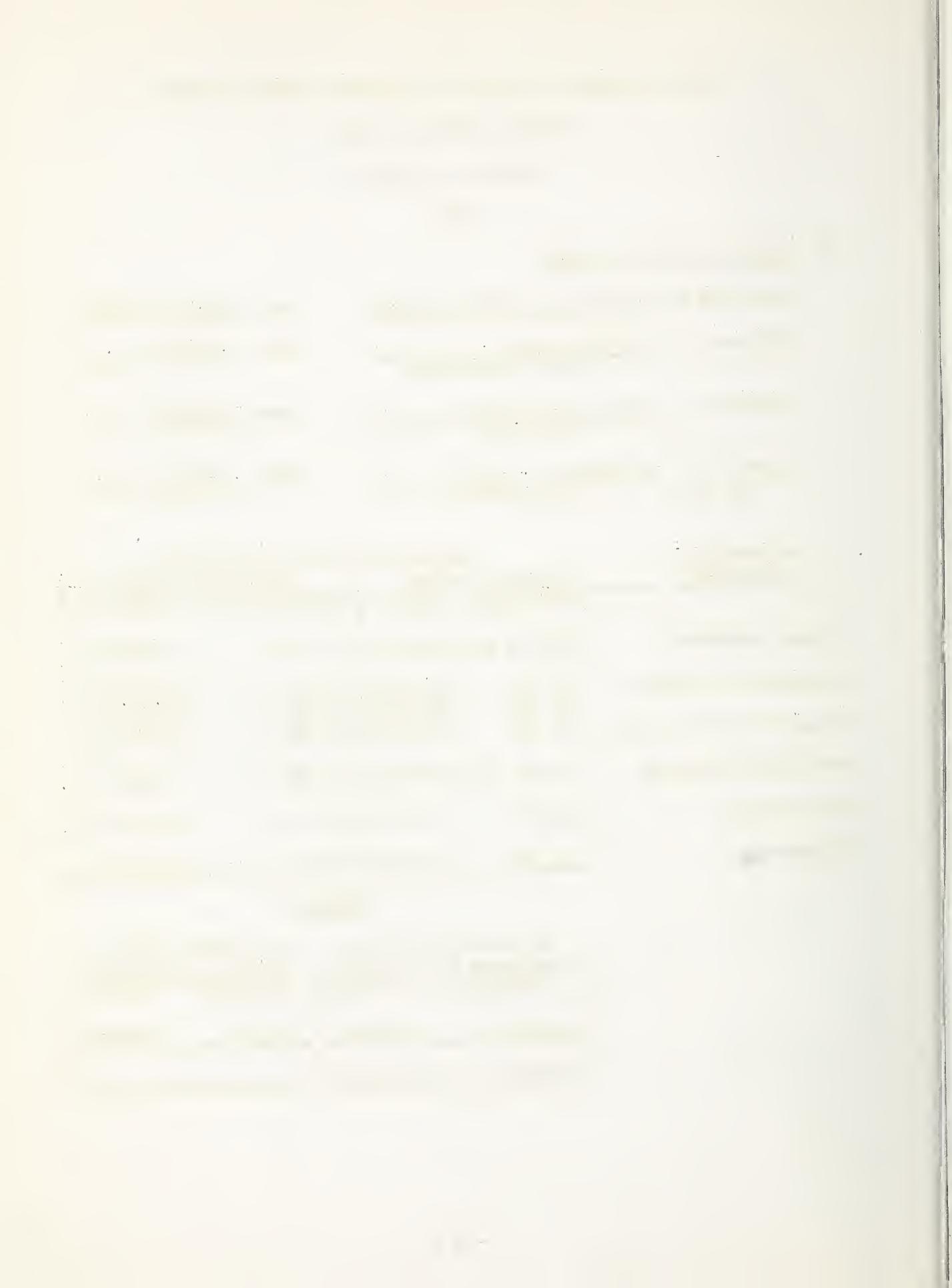
Reviewed by:

NATIONAL FOREST ADMINISTRATION

DIVISIONS	Regional Office	Washington Office
	: Initials Date	: Initials Date
Timber Management	<u>/s/ JRC</u> AGL 10-24-58	<u>/s/ IJM</u> 1-26-59
Recreation and Lands	<u>/s/ EB</u> 10-20-58	<u>/s/ JS</u> 11-18-58
Range and Wildlife Mgt.	<u>/s/ VNS</u> 10-23-58	<u>/s/ CAJ</u> 11-21-58
Watershed Management	<u>/s/ MAG</u> 10-23-58	<u>/s/ LWS</u> 11-25-58
Fire Control	<u>/s/ EB</u> GFC 10-20-58	<u>/s/ WLS</u> 1-13-59
Engineering	<u>/s/ MET</u> 10-21-58	<u>/s/ MSL</u> 12- 5-58

RESEARCH

	Intermountain Forest	Washington Office
	and Range Exp. Station	Branch of Research
	Initials Date	Initials Date
	<u>/s/ CAW</u> 10-20-58	<u>/s/ CEO</u> 1-21-59
	<u>/s/ EVR</u> 10-20-58	



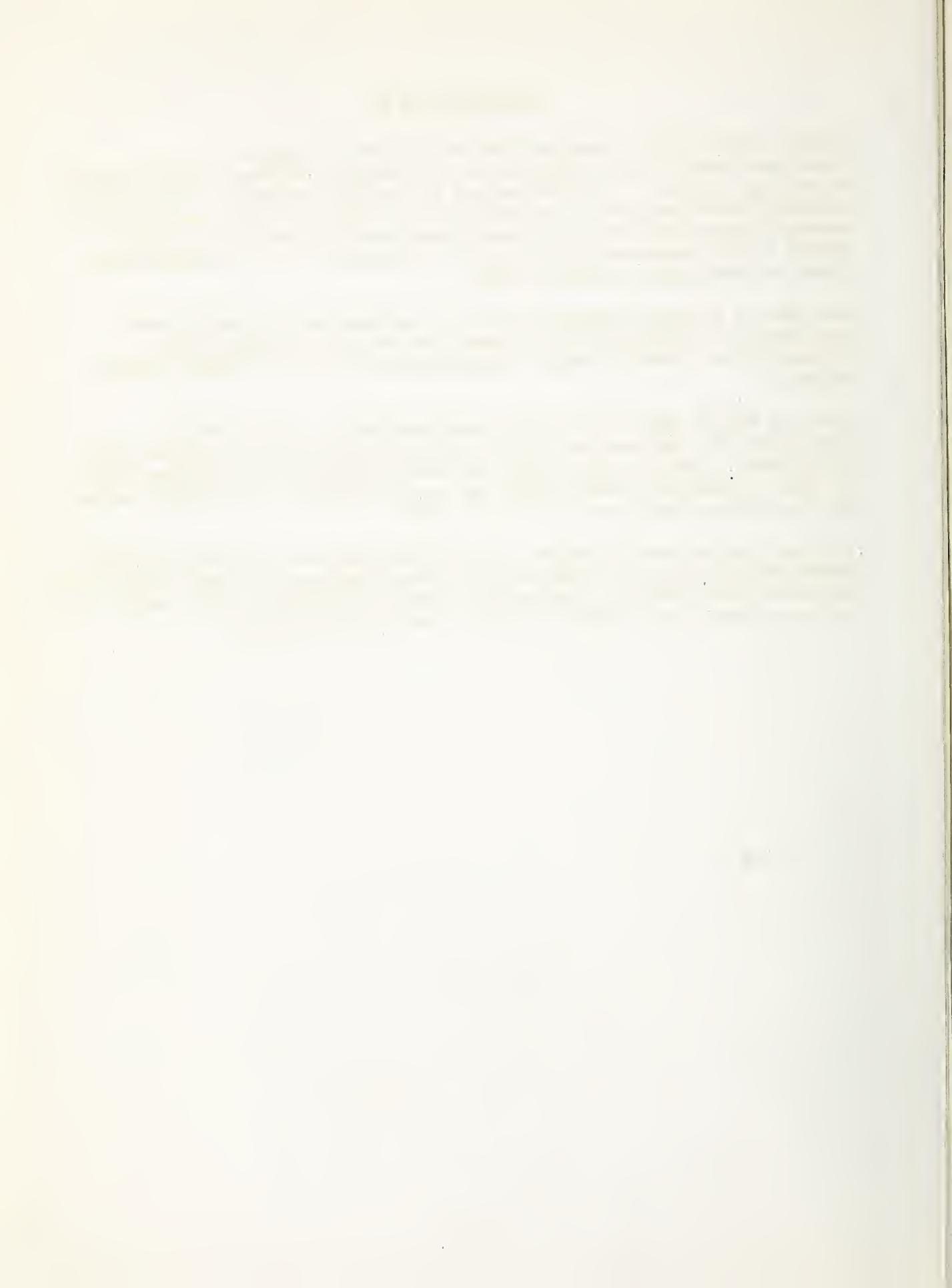
FOREWORD

Forest Service policy requires the development and application of sustained yield timber management of the national forests, working circle by working circle. It is the purpose of the plan to apply the management policies and objectives of national forest administration growing out of related Federal laws and as currently set forth in the Forest Service Manual to the management of the timber resources of the national-forest lands in the Lincoln Working Circle.

The plan is primarily concerned with the nonreserved national-forest ownership, but consideration is also given to the intermingled and adjacent forest lands in other ownerships and how they influence local economy.

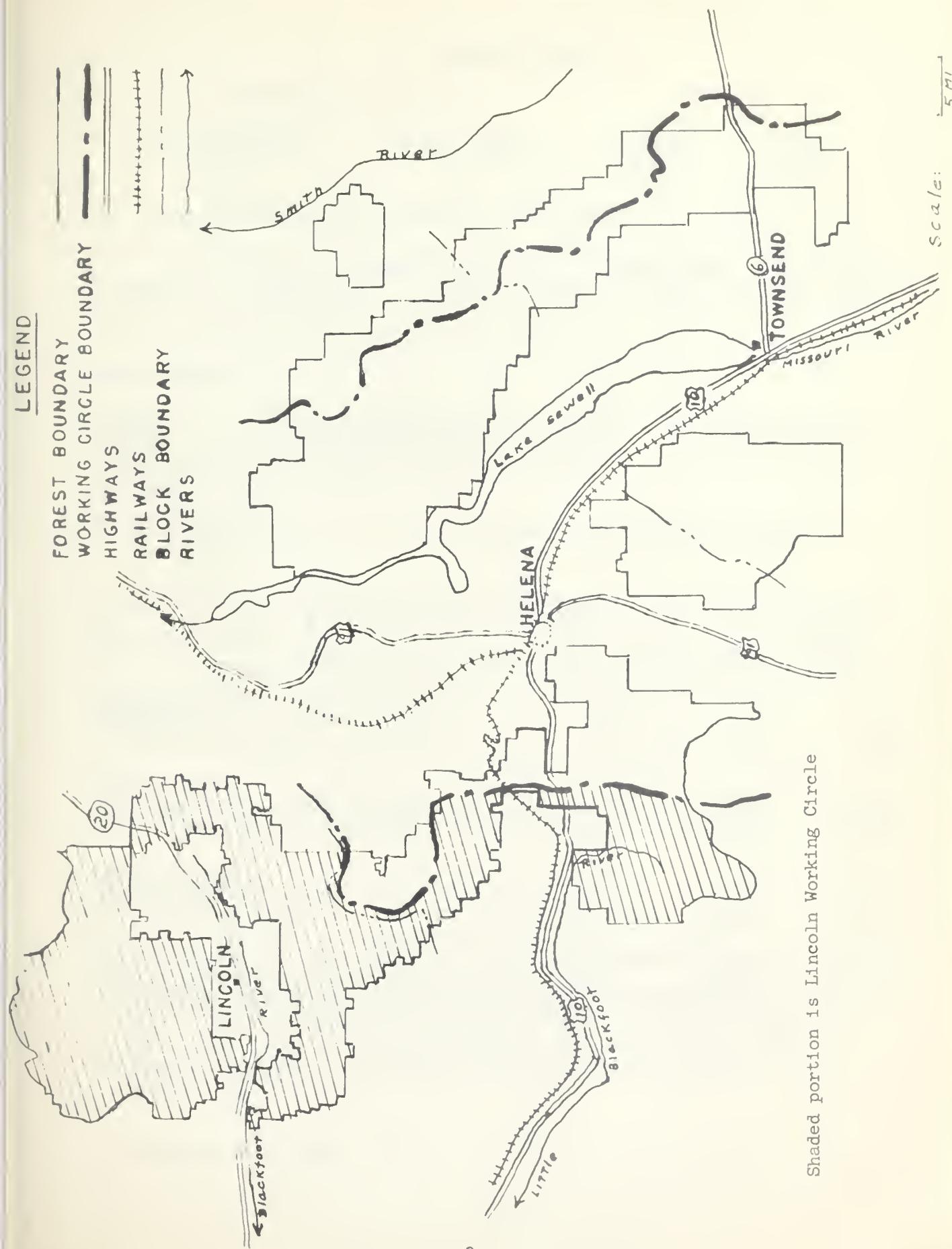
Area and volume data for the plan were obtained by use of aerial photographs for one hundred percent timber typing and field sample plots for volumes. The accuracy of the volumes is based upon a sampling error of plus or minus ten percent based on one probability. The timber survey was made during the years of 1956 and 1957.

The plan was written by Rangers William MacKenzie and Bert Morris of the Helena and Lincoln Districts, and by Timber Management Assistant Carl Marsh, under the supervision of the Assistant Forest Supervisor, Vern Hamre, and coordinated by Corland L. James of the Regional Office.

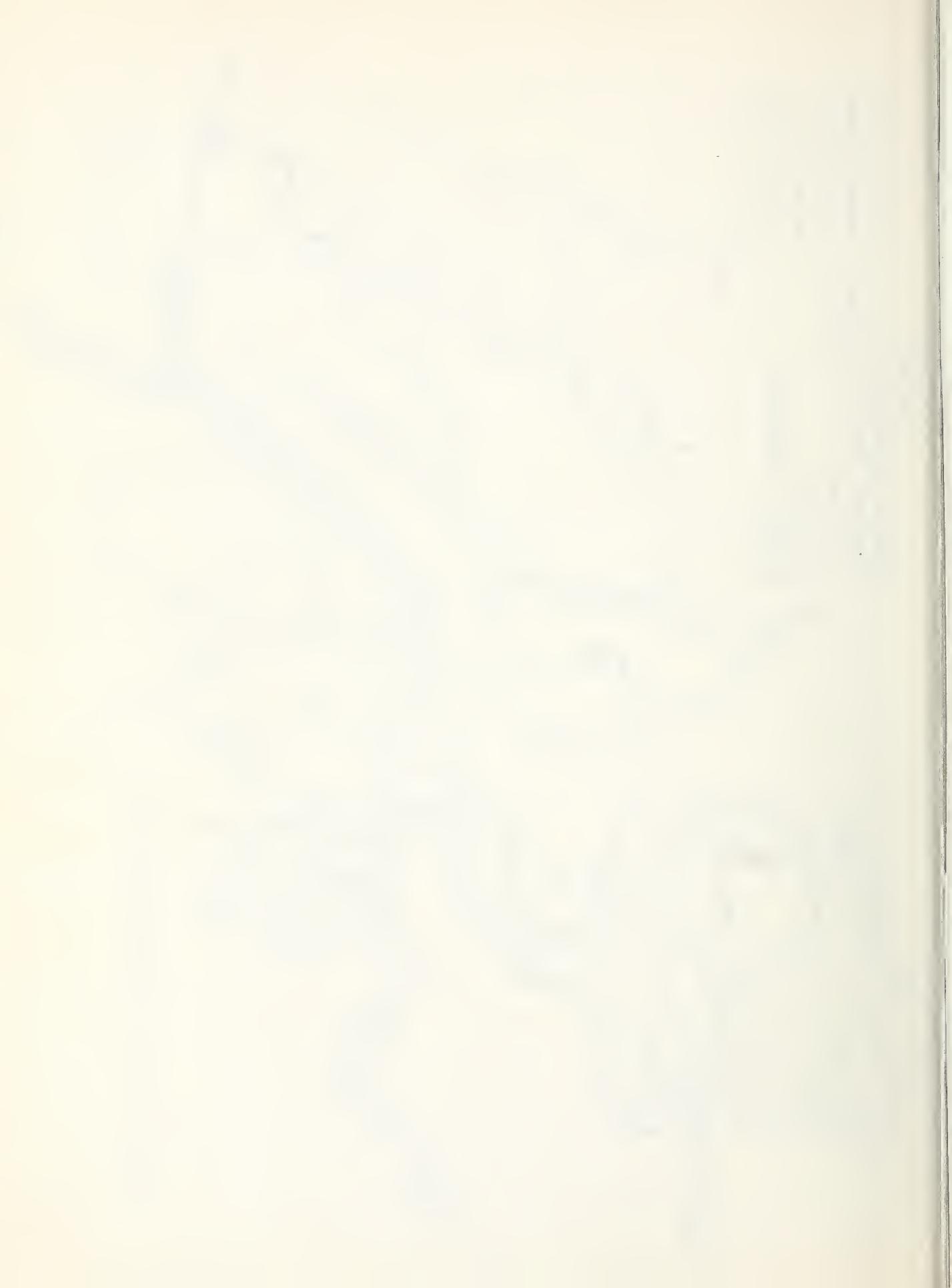


LEGEND

- FOREST BOUNDARY
- WORKING CIRCLE BOUNDARY
- HIGHWAYS
- RAILWAYS
- BLOCK BOUNDARY
- RIVERS



Shaded portion is Lincoln Working Circle



C. SUMMARY OF PLAN

1. Area of commercial forest land.

National Forest	Other Federal	Private	Total
375,279	160	19,518	394,957

2. Total timber volume on commercial forest land.

Ownership	Sawtimber (M b. m.)				Other Products (M cords)*			
	PP	DF	LPP	Total	PP	DF	LPP	Total
Nat'l Forest	16,229	822,362	333,412	1,172,003	16	1,115	3,207	4,338
Other Federal		537	92	629				
Private	1,717	50,224	14,617	66,558				
TOTAL	17,946	873,123	348,121	1,239,190	16	1,115	3,207	4,338

* Conversion factors used: 90 cu. ft. per cord;
2 cords per MBM (Scribner Dec. "C")

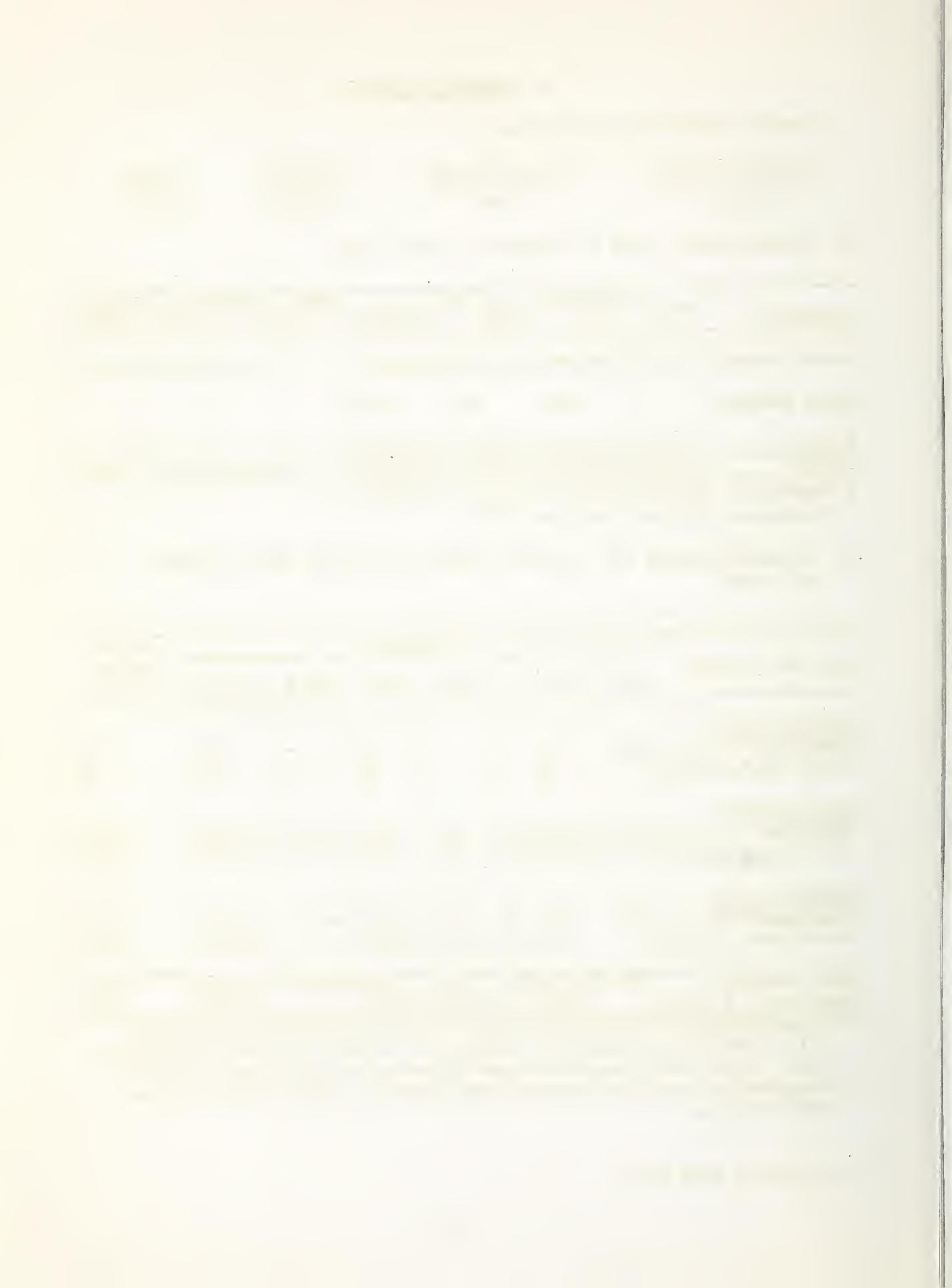
3. Allowable annual cut - Lincoln Working Circle by type, species and area.

Type and Product	Species								Acres Cutover Annually
	PP	DF	S	AF	LPP	WLP	L	Total	
Ponderosa Pine*									
Sawtimber (M b. m.)	148	46	-	-	12	-	-	206	34
Other Prod. (Cords)	-	45	-	-	30	-	-	75	34
Douglas-fir**									
Sawtimber (M b. m.)	250	10,266	308	19	655	39	58	11,595	1,926
Other Prod. (Cords)	-	6,891	235	214	920	-	-	8,260	1,926
Lodgepole Pine									
Sawtimber (M b. m.)	36	700	36	646	6,514	466	-	8,398	3,230
Other Prod. (Cords)	-	967	255	1,000	53,044	-	-	55,266	3,230
Total Sawtimber	434	11,012	344	665	7,181	505	58	20,199	5,190
Total Other Products	-	7,903	490	1,214	53,994	-	-	63,601	5,190

* Ponderosa pine type allowable cut is shown for reference purposes only. Its volume should be included in the total for the Douglas-fir type. Reference discussion under "Calculation of allowable cut."

** Douglas-fir type also includes small areas of larch, alpine fir and spruce types.

4. Revision date 1967



D. MANAGEMENT PLAN

1. SUMMARY OF RESULTS OF PREVIOUS PLANS

No previous plans have been made for the Lincoln Working Circle. Prior to 1955, very little logging was done. This was due to economics and inadequate transportation facilities. The hard and long haul from the Lincoln area wiped out any reasonable profit margin necessary for an efficient operator to stay in business.

The completion of the new Rogers Pass Highway has now placed this area in a competitive situation with other lumber producing areas in western Montana.

On the Helena Block, quality of the timber has been the restrictive factor. With an outlook for higher lumber values in the future and the possibility of a pulpwood market, the timber in this part of the Lincoln Working Circle should become marketable in the near future.

2. LAND DESCRIPTION

a. Boundaries

Included in the boundaries of this working circle are all of the Lincoln District and that portion of the Helena District lying west of the Continental Divide. The working circle includes portions of the Lewis & Clark and Powell Counties. The main drainages in the working circle are the Little Blackfoot River, Nevada Creek, the Blackfoot River, and the east fork of the north fork of the Blackfoot River. A small part of the Lincoln Block (36,494 acres) is east of the Continental Divide. Lincoln is 85 miles east of Missoula and 88 miles west of Great Falls.

b. Subdivisions

(1) Blocks - The Lincoln Working Circle is divided into two blocks: the first being the entire Lincoln Ranger District and the second being that portion of the Helena Ranger District lying west of the Continental Divide.

(2) Compartments - The Lincoln Working Circle includes 55 compartments, of which 43 compartments are in the Lincoln Block and 12 compartments in the Helena Block. The compartment boundaries were laid out on topographic features such as ridges and creeks, and compartments have an average size of 8,130 acres. Some of the larger and smaller blocks were occasioned by physiographic features that created logical management units.

c. Relation to Other Working Circles

On the north, the working circle is bounded by the Four Rivers Working Circle of the Lewis & Clark National Forest; on the west, by the Missoula Working Circle of the Lolo National Forest; on the south, by the Deerlodge Working Circle of the Deerlodge National Forest; and on the east, by the Helena Working Circle.

3. FOREST DESCRIPTION

a. Areas by Types, Sites, and Age Classes

(1) Areas by types and size classes - The Lincoln Working Circle has 375,279 acres of national-forest, nonreserved, commercial forest area. On this area the following types and size classes are found:

Timber Type	Sawtimber	Poles	Seeds. & Saplings	Nonstocked	Total
Lodgepole Pine	11,493	161,493	33,334	1,161	207,205
Douglas-fir	121,995	34,418	1,071	109	157,593
Spruce	5,475	677	0	0	6,152
Ponderosa Pine	2,675	21	0	0	2,696
Larch	873	0	0	0	873
Alpine Fir	131	0	15	0	146
Spruce-Alpine Fir	78	38	0	0	116
Whitebark-Limber Pine	197	301	0	0	498
TOTALS	142,917	196,948	34,420	1,270	375,279

For a breakdown of types and size classes for other ownerships, see table 4 in the appendix.

It can be seen from this that lodgepole pine is the most extensive type, with Douglas-fir as the second most extensive. Other timber types are rather minor in acreage, although both spruce and ponderosa pine are locally important.

It can be further noted that there is a marked preponderance of sawtimber and pole sizes in the working circle.

(2) Areas by age classes - Age-class structure was determined from the field sample data rather than being determined from an age class map. The following age class data for the two principal timber types have been determined from the inventory:

	Timber Type	
	Lodgepole Pine	Douglas-fir
Nonstocked	1,161	109
0- 40	43,696	8,892
41- 60	20,725	11,730
61- 80	24,179	46,924
81-100	34,542	31,283
101-120	-	3,910
121-140	24,179	15,641
141-160	20,725	11,730
160+	37,996	27,372
TOTAL	207,205	157,594

This indicates that 52 percent of the lodgepole pine type and 75 percent of the Douglas-fir is less than rotation age. As a whole, this working circle has very nearly the best age-class structure in the region.

(3) Areas by sites - Site class measurements for each field sample were taken. From this data the following sites by types based on regional site tables are indicated:

SITE TABLE FOR NATIONAL FOREST NONPRESERVED COMMERCIAL FOREST AREA

Timber Type	Good		Medium		Poor	
	Percent	Acres	Percent	Acres	Percent	Acres
LPP	11	22,792	43	89,098	46	95,314
DF	-	-	5	7,880	95	149,713
PP	-	-	100	2,696	-	-
S	-	-	50	3,076	50	3,076
AF	-	-	50	73	50	73
WLP	-	-	-	-	100	498

When cubic volume is plotted over age in the lodgepole pine type, the volume of present stands at rotation age is 4,700 cubic feet on good sites versus 2,800 cubic feet on medium sites and 1,050 cubic feet on poor sites.

(4) Type description - Seven distinctive types are recognized within the forest boundaries. Timber types are based on the plurality of the cubic foot volume or number of trees of any one species. Following is a brief description of each type. For more detailed description, see R-1 marking rules:

Lodgepole Pine type makes up 55 percent of the cover type. Generally the stocking is normal for site; however, there are many seedling and sapling stands and pole stands where the lodgepole is overstocked.

Douglas-fir type includes 42 percent of the cover type. This is for the most part medium stocked; i.e., 40 percent to 69 percent of the tree crowns are closed. There are some areas of parklike Douglas-fir type where the stocking is poor from a crown-closure or basal-area standpoint, but it is felt that this situation is normal for the site. Thrift of Douglas-fir is being severely affected by the spruce budworm. In the small area of the Lincoln Working Circle where the spruce budworm is not in epidemic populations, the Douglas-fir is thrifty.

Spruce type, including alpine fir, comprises 2 percent of the cover type. These are minor species on the area, found on the moist sites in stringer type stands.

Ponderosa Pine is found on 3,004 acres (1 percent of the entire working circle). Though minor in acre size, this species is important from an economic value standpoint. There are presently many acres occupied by Douglas-fir type which, under closer management, could be changed to a ponderosa pine type.

Larch type includes 873 acres and is located in one compartment of the working circle.

Whitebark-Limber Pine type is found at the higher elevations. It is primarily a soil stabilizer on high watershed areas and occupies only 515 acres.

b. Stocking and Thrift

The table of area of national-forest land in the Lincoln Working Circle indicates that the lodgepole pine type averages medium stocking, and the Douglas-fir and spruce types average slightly less than medium. Most of the ponderosa pine type is medium stocked.

While a number of overmature stands are now showing heavy mortality, the unit as a whole is of better than average thrift for the region.

c. Timber Quality

During the inventory of this working circle, sample trees were log graded on each plot in accordance with Forest Survey log grades to provide information concerning sawtimber quality. The following table summarizes this data:

TIMBER QUALITY DATA SUMMARY

LOG GRADES

Species	Percent by Volume			
	Grade 1	Grade 2	Grade 3	Grade 4
Ponderosa Pine	10	24	31	35
Douglas-fir	-	10	54	36
Lodgepole Pine	-	10	62	28
Engelmann Spruce	-	-	47	53
Alpine Fir	-	21	75	4
Whitebark- Limber Pine	-	21	58	21
Cottonwood	-	47	53	-

The foregoing indicates that the lodgepole pine is probably of better quality than average working circles in the region and that the ponderosa pine, Douglas-fir, and spruce are below average.

Such information will be useful in making comparisons of quality trends in subsequent inventories. Also, it will provide a basis for comparing the quality of sawtimber being sold when mill studies become available to evaluate this data. Such quality information should be helpful to industry representatives in evaluating industrial opportunities in the area.

4. MANAGEMENT OBJECTIVES

a. Community Support

(1) Permanent communities - Lincoln is the only community within the working circle which has a forest industry. There are ten small circular sawmills within the Lincoln Block at the present time. Because of its strategic location, it is expected that the sawmills in Lincoln will develop more efficient processing, which will include dry kilning and planing of most of the lumber. The sawmills in the Lincoln area have been producing about 7 MM board feet per year since World War II, mostly from private lands. As the timber on private lands in the Lincoln area becomes exhausted, the dependency of these sawmills will shift to national-forest timber. When the Lincoln Block attains the full allowable cut, it is expected that timber processing will offer about three times the present employment.

On the Helena Block there are no communities having forest products industries. It can be expected that with utilization of timber in this block, processing plants may develop in the Elliston-Avon area. Since the Helena Block is easily accessible to railhead, there is a good possibility that most of the material suitable for pulpwood will be shipped out to pulp plants located at Missoula or Three Forks.

(2) Logging Camps - Commuting time to and from the most remote corner of the working circle is short enough so that it will not be necessary to establish additional temporary or permanent communities.

b. Silvicultural

These objectives are stated concisely as follows:

- (1) To secure quick reproduction after removal of timber.
- (2) To produce valuable species instead of those having little or no market value.
- (3) To obtain full stocking and maximum yield compatible with site.
- (4) To produce trees of good form and quality.
- (5) To obtain the most rapid growth compatible with a full stand and good quality.

5. COORDINATION WITH OTHER USES

The guiding principle of the Forest Service has been multiple use. The principle of multiple use recognizes desirability of developing and utilizing areas, or even individual acres, for more than one purpose: watershed protection, water production, timber production, forage production, hunting and fishing, winter sports or other outdoor recreation must be correlated. In order to accomplish this correlation, the following guidelines must be observed:

a. Water

Objectives: watershed management consists of the management of vegetative resources in a drainage basin with the following objectives in view:

- (1) Reduction of flood discharges.
- (2) Control of water quality.
- (3) Timing of water yield to meet water needs.
- (4) Maximum perennial streamflow.

The first three of these objectives, and especially the first two, appear to be the main objectives of water management within the Lincoln Working Circle. Hydrologic conditions needed to accomplish these first two objectives are few in number but important in their effects and appear as follows:

- (1) Conditions needed to hold down flood discharges:
 - (a) High infiltration capacities.
 - (b) High soil permeability.
 - (c) High storage capacity in soil mantle.
 - (d) Unimpaired channel capacities free of logging debris.
 - (e) Control of snowmelt rates.
 - (f) Surface storage of water.
- (2) Conditions for controlling water quality:
 - (a) Protective cover on soil surface.
 - (b) Anchoring of soil by binding of roots and organic material.
 - (c) Low surface runoff.
 - (d) Well-sodded channel bank for prevention of scars.

Watershed conditions in the management unit:

No major watershed problems exist on the Lincoln Working Circle at this time. The soils of the Lincoln Working Circle are not highly erosive. There are no local municipal water supplies dependent upon water from the Lincoln Working Circle. Logging and road building activity in the past have not been extensive enough to cause watershed problems.

There is an area in the Nevada Creek drainage which has loose shale soils. Disturbance of vegetation on these loose shale soils by logging, grazing of domestic stock, or wildlife causes severe soil movement. Logging on these areas of shale soils will be restricted to areas where no permanent damage will be done to vegetation.

Specific measures to obtain watershed objectives:

Some of the specific things that will be done to improve watershed management on timber sale and other areas are:

- (1) Fall streamside trees, which must be cut, away from the stream.
- (2) Keep tractors and other equipment out of the channels and away from the banks.
- (3) Keep logging and road building debris out of stream and out of reach of high water.
- (4) When building roads in and below logging areas, be sure that bridges and culverts are large enough to carry unusually high flows and constructed to minimize the probability of plugging with debris.
- (5) Road grades should not restrict creek channels or put loose material into situations where it is likely to be carried away by running water.
- (6) Accepted measures for preventing erosion on roads, skid trails, landings, and burns will be followed and will be specified in timber sale contracts.
- (7) There will be instances where watershed considerations will dictate that marginal stands on upper slopes or poor sites are better left as protective cover than cut on the unlikely possibility of getting an improved future stand.
- (8) Peak flow measurements are needed for the purpose of estimating bridge and culvert specifications capable of handling probable discharges.
- (9) Further research is needed to determine the local effects of timber harvest methods on peak streamflow and sediment yield.

b. Wildlife

Large fires in the past years have created extensive openings which contributed to establishing large deer and elk populations in the Blackfoot drainage. Most of these openings were restocked with conifers which have grown to create a closed canopy, eliminating winter food supplies. At the same time, deer and elk populations continue to increase to the point where they have outgrown their food supply, and conifer reproduction within reach is being severely damaged on winter ranges.

Patch cuttings in big game winter range areas will undoubtedly produce more game feed which may, in many instances, result in a deforested condition. In areas such as this where we have excessive big game populations, we can expect that timber growth will become subordinate to game. The two uses on winter ranges are incompatible. Additional studies must be undertaken to provide a workable solution to this problem.

Clean, cool streams and lakes with good, fast, food-producing capabilities are found on this working circle. There are 279 miles of fishing stream, varying in fishing potential from average to excellent. There are 15 lakes for a total area of 78 acres. These lakes are small and offer very good fishing opportunities. With the development of more use of these areas by sportsmen, programs of habitat improvement and fertilizing stream and lakebeds will be encouraged by the Forest Service.

Timber will be preserved adjacent to trout streambanks. Wherever possible, roads paralleling streams will be constructed far enough from streams to permit a buffer strip of forest cover between stream and road. The buffer strip along streams will provide a favorable water temperature for the trout, and act as a stabilizer for the streambank and filter for surface runoff from the road.

The road building program, in conjunction with the timber utilization, will provide a considerably larger area that is readily accessible to the sportsman, both hunter and fisherman. Since the harvest of game crop produced by the habitat is one of the essential phases of good game management, the building of roads will increase the volume and value of game available to the public.

c. Recreation

(1) Recreation potential - The recreation potential of the Lincoln Working Circle is one aspect of land use that will be considered in all planning because of the location of the area. Great Falls, with a population of 60,000; Helena, with a population of 25,000; and Missoula, with a population of 35,000; for a total of 120,000, are all within two hours' highway travel of the major portions of the management unit.

(2) Major recreational activities - Presently the major recreational use of the area is hunting and fishing. In the near future, more resorts are expected in and adjacent to the area. Winter sports may also be developed. One of the major uses that deserves consideration is the aesthetic appreciation. Two transcontinental routes traverse the area, channeling a great amount of through tourist traffic whose primary enjoyment of the area is its pleasant scenery.

(3) Throughout the entire working circle the objective will be to safeguard recreational values. Careful attention will be given to the following:

- (a) Current policies with regard to the preservation of roadside and streamside strips will be observed.
- (b) Logging across streams will not be permitted because of detrimental effect on recreation and watershed values.
- (c) Areas having primary value for recreation will be delineated, and timber harvesting and road building will be done in a manner to preserve the recreational values. The objective of timber management in the roadside zone will be to maintain a good stand of timber and present attractive forest conditions to the recreational traveler.
- (d) Care will be exercised in using existing roads and in the construction of new roads that the use for timber harvesting does not result in the elimination of other uses of the road. Standards of construction will be based on over-all use.

d. Grazing

(1) Presently on the Lincoln Block there are over 600 head of cattle and 4 bands of sheep under grazing preference permits. Some of the allotments present problems in range management. The timber harvesting will provide access and better distribution for some of the problem areas. As timber is the climax type for the entire block, timber in no place will be subordinated to livestock grazing.

(2) On the Helena Block, grazing is codominant with timber use. On the average, there are 1,300 head of cattle and 7 bands of sheep grazed on the unit each year. There are large grassy parks intermingled with the forest stand. Poorly located jeep roads give accessibility to part of the area. These, combined with future land access and land use roads, will give better distribution control of the grazing animals.

It will be the policy on the Helena Block to maintain the acreage of the two types of land use in status quo and concentrate more on improving the productivity of the two types of land use on the ground now occupied by each.

e. Mining

The Lincoln Working Circle has an estimated total of 250 patented mining claims and 2,000 unpatented mining claims within its boundaries. The patented mining claims date back to the Gold Rush days of 1860. The claims are distributed in every part of the working circle. In the early days around 1862, gold mining centers were developed around Lincoln Gulch and the now ghost town of Blackfoot City.

Mining activity has subsided to the point where there are two lode operations--a phosphate mine and one dredging operation which are working either on a paying basis or marginal basis. These operations at present are causing no interference with timber management.

Indiscriminate dozer prospecting, the residues left from early lode mining recovery processes, and dredging operations present management problems that can be attributed to mining. The mining claims are interfering with the efficient administration of the national forest.

Public Law No. 167, July 23, 1955, will, by determination of surface rights, help resolve the mining claim problems.

Priorities of claim examinations by sections of the working circle have been established for the region, and it is planned to complete field search within the next few years.

f. Private Forestry

It is planned to establish demonstration areas, with adequate signing, to illustrate to forest industries and to the general public what we are doing and what can be done silviculturally.

6. REGULATION

a. Rotation

Rotation has been defined as the period of years required to establish and grow timber crops to a specified condition of maturity. Length of rotation that is adopted for each timber type or specie has a bearing upon the allowable cut in the present mature and old growth stands; the shorter the rotation for the next generation of trees the greater will be the allowable cut, and the longer the rotation the less the allowable cut. The determination of the length of rotation depends on four major factors as follows:

(1) Economic - Maximum average volume production or age of culmination of mean annual increment.

(2) Silvicultural - Age at which the reproductive capacity is greatest and the age beyond which the disease resistance becomes less.

(3) Technical - Maximum amount of products of a specified size or character.

(4) Financial - The age or length of rotation which will give the best return on the money invested or the maximum net profit.

In establishing the rotation ages for the types found on this working circle, the first three factors were considered. The fourth factor was given some weight, but, in the present stage of management on national-forest lands, it is not practical to organize a working circle, and grow and harvest timber crops solely with the view of obtaining the greatest monetary return. Other uses, such as watershed protection, recreation, and wildlife, must be considered.

When the point is reached where intensive management will be practiced, site will have to be considered very closely, for site has an important bearing on the length of rotation. As a general rule, the better the site, the shorter the rotation age based on point of culmination of mean annual growth. Until more intensive management is practiced, the rotation age will be based upon averages for the site conditions.

Future management can reduce the technical rotation age by stand improvement measures which make it possible to put the total growth on fewer stems and thereby reach a specified size in a shorter length of time.

Considering all the preceding factors, the following guides of rotation age were used in determining allowable cuts by primary products:

Type	Rotation	Primary Product
Ponderosa Pine	140 years	Lumber
Douglas-fir 1/	140 years	Lumber, fiber
Lodgepole Pine 2/	100 years	Pulpwood, lumber, poles, piling

1/ Includes larch, spruce, spruce-alpine fir and alpine fir

2/ Includes whitebark-limber pine

These rotation figures are averages. There will be considerable variation by site, quality, and other considerations.

b. Cutting Cycles

In general, all the timber types within this working circle will be managed on the even-aged basis. There will be exceptions. With this type of management, the cutting cycle is the same length as the rotation.

c. Growth and Mortality

The preponderance of older stands in the Douglas-fir type and large areas of overstocking in the lodgepole pine pole type have decreased the net growth to below normal. The spruce budworm is reducing annual increment and causing mortality in the younger populations of Douglas-fir stands.

Following is a table showing average site, estimated average stocking, net mean annual increment, and estimated realizable net mean annual increment:

Timber Type	Average Site ^{1/}	Average Stocking (Percent)	Net M.A.I. (Per A.) ^{2/}	Estimated Realizable Net M.A.I. (Per A.) ^{2/}	Total W. C. Net P.A.I. (M cu. ft.)
Douglas-fir	Poor	41	55 ft. b. m.	98 ft. b. m.	4,728
Lodgepole Pine	Medium & Poor	55	23 cu. ft.	33 cu. ft.	4,101
Ponderosa Pine	Medium	49	60 ft. b. m.	162 ft. b. m.	-

^{1/} See page 12

^{2/} Scribner Rule

d. Methods of Cutting

In the following paragraphs where clear cutting in patches is indicated, it is intended that such clear-cut areas shall be as small as practical from the standpoint of economical logging operations and other considerations, such as silvicultural. The economy of future logging, as well as the present, should enter into the selection of the areas and their size. In general, it is intended that patch cutting shall not cover more than fifty percent of the mature timber in any compartment during the first harvest cut. Each clear-cut patch should be from about 10 to 30 acres, with an upper limit of 50 acres. Shape of the clear-cut area is an important factor where seeding from the side is depended upon for regeneration of the stand. Narrow clear-cut areas may be larger than those that are nearly as broad as they are long. Regional marking guides provide the limitations for each timber type.

It is anticipated that when the uncut areas of timber are logged in the future, adequate restocking of desired species can be obtained by one or more of the following:

- (1) seeding from the perimeter of cutover units to establish advance reproduction; (2) seeding from adjacent uncut timber too

young, too poor, or too inaccessible to be logged up to that time; (3) coordinating cutting with seed production and applying proper slash disposal; (4) leaving seed trees; and (5) planting.

Current logging methods when used in thick stands of young mature timber have been destructive to residual trees. The damage resulted from two factors: (1) the large logging tractors have skinned or knocked down residual trees, and (2) fallers hang up trees and fall one to three leave trees to dislodge them. Clear cutting in blocks would remedy these two evils resulting from partial cutting. Jammer skidding may eliminate or reduce the damage in the residual timber in partial cutting.

For further information, see approved Regional Marking Guides in the appendix.

SUMMARY BY SPECIES:

Douglas-fir type

Clear cutting in blocks or strips will be the general rule. The clear-cut blocks or strips will not be excessive in size; they will be strategically located in relation to the uncut blocks which will provide the main seed source for restocking the cut blocks. Stands selected for clear cutting should be predominantly mature and overmature and even in size and/or age class.

In stands with light stocking or on dry sites, or in storied stands, marking on a partial-cut basis is desirable. However, where there is mistletoe infection, clear cutting will be practiced. With mistletoe present, partial cut increases the rate of spread and the intensity of the parasite.

Improvement cuts in immature stands are recommended, provided they will pay their way and the cutting will not result in excessive damage to the residual stand.

Lodgepole Pine Type

The marking instructions referred to previously cover in detail all the conditions which will be encountered in this working circle to meet the following objectives:

- (1) To grow essentially even-aged stands of well-formed, thrifty trees.
- (2) Create a desirable distribution of age classes.
- (3) Improve stand vigor in order to reduce possibilities for serious damage from insect and disease epidemics.
- (4) Reduce dwarfmistletoe infections.
- (5) Maintain desirable watershed conditions.

Ponderosa Pine Type

Objectives:

- (1) To adjust the silvicultural treatment by unit areas or natural units. Silvicultural systems will be applied according to the needs and conditions of each homogeneous stand unit rather than according to generalized rules. Under this unit control system, the tendencies should be to mark trees in small groups where age class and vigor grouping permit. Because ponderosa pine is a relatively intolerant species and grows best in even-aged groups, small clear-cut areas permit better establishment of reproduction and the full development of seedlings and poles.
- (2) Douglas-fir and lodgepole pine tend to take over some of the ponderosa pine stands. To offset this tendency, these species should be cut heavily in the first cutting cycle to make room for the regeneration of ponderosa pine.

Spruce Type

Wind firmness is the key factor in determining the method of cutting. The tolerance of spruce would indicate uneven-aged management, but past experience has shown that selectively cut stands suffer heavy windthrow unless located in protected sites. It is the policy to clear cut in patches for the type in general. In areas where the type occurs in stringers along stream bottoms, a light partial cut should be made, removing only overmature and defective trees. Light cuts and the protected location of most streamsides may make it possible to cut on a partial basis without the usual damage of windthrow.

e. Growing Stock Objectives

The growing stock conditions can be improved as the older age classes are removed in an orderly process with area control of cut. As steps toward improving the growing stock conditions, the following objectives will be kept in mind:

- (1) Older stands will be cut as fast as the allowable cut will permit.
- (2) Maintain approximate equal size of areas cut, year by year.
- (3) Restock and increase number of stems per acre in areas that are at present nonstocked and understocked in young stands.
- (4) Strive for the normal growing stock objectives.

f. Calculation of Allowable Cut

The volume regulation formula which is most applicable to the inventory data is the Kemp formula. It not only is the most applicable to the data on hand, but its use has been found satisfactory in comparison with other more intricate methods. With it, calculations of allowable annual cut were made for each type, and these combined to get the total for the working circle.

The allowable cut was also computed with the Austrian, Von Mantel, and Hanzlik formulas. It is significant that the Kemp formula gave a figure that was nearer to the average than either of the other methods. (See calculations of these formulas as shown in the appendix.) Because of this, and because of the formula which readily lends itself to checking, the allowable cut was set to agree with this figure.

The actual cut shall not exceed the allowable cut by more than 25 percent for any one year and not more than 5 percent in any five-year period.

The spruce, western larch, alpine fir, and spruce-alpine fir types have been combined with the Douglas-fir type for allowable cut calculation purposes. These types occupy small areas and, consequently, their allowable cuts would be small. With a small annual cut, it would be impossible to manage on a sustained-yield or continuous basis.

In general, most of the ponderosa pine volume is scattered throughout the lower areas and around the periphery of the forest. Access roads through these areas are needed before a regulated harvest cut can be accomplished in the entire working circle. Due to this reason, the fact that there is a relatively minor amount of the total volume involved, and because the working circle is in its early stages of development, the ponderosa pine values are needed to help amortize new access roads. An allowable cut for this species was not established. The ponderosa pine volumes are included in the allowable cut for Douglas-fir.

On the following page is a table that allocates the annual allowable cut for the working circle by blocks. This allocation of cut by blocks may be changed by the forest supervisor.

ALLOWABLE ANNUAL CUT BY BLOCKS, TYPE, SPECIES & AREA

Type and Product	Species								Acres cutover annually
	PP	DF	S	AF	LP	WLP	L	Total	
<u>LINCOLN BLOCK</u>									
Ponderosa Pine									
Sawtimber (M b. m.)	148	46	-	-	12	-	-	206	34
Other Prod. (Cords)	-	45	-	-	30	-	-	75	34
Douglas-fir									
Sawtimber (M b. m.)	200	8,213	246	15	524	31	47	9,276	1,541
Other Prod. (Cords)	-	5,513	188	171	763	-	-	6,635	1,541
Lodgepole Pine									
Sawtimber (M b. m.)	25	490	25	452	4,560	326	-	5,878	2,261
Other Prod. (Cords)	-	677	178	700	37,131	-	-	38,686	2,261
Total Sawtimber	373	8,749	271	467	5,096	357	47	15,360	3,836
Total Other Prod.	-	6,235	366	871	37,924	-	-	45,369	3,836
<u>HELENA BLOCK</u>									
Douglas-fir									
Sawtimber (M b. m.)	50	2,053	62	4	131	8	11	2,319	385
Other Prod. (Cords)	-	1,378	47	43	157	-	-	1,625	385
Lodgepole Pine									
Sawtimber (M b. m.)	11	210	11	194	1,954	140	-	2,520	969
Other Prod. (Cords)	-	290	77	300	15,913	-	-	16,580	969
Total Sawtimber	61	2,263	73	198	2,085	148	11	4,839	1,354
Total Other Prod.	-	1,668	124	343	16,070	-	-	18,205	1,354
<u>TOTAL LINCOLN WORKING CIRCLE</u>									
Ponderosa Pine									
Sawtimber (M b. m.)	148	46	-	-	12	-	-	206	34
Other Prod. (Cords)	-	45	-	-	30	-	-	75	34
Douglas-fir									
Sawtimber (M b. m.)	250	10,266	308	19	655	39	58	11,595	1,926
Other Prod. (Cords)	-	6,891	235	214	920	-	-	8,260	1,926
Lodgepole Pine									
Sawtimber (M b. m.)	36	700	36	646	6,514	466	-	8,398	3,230
Other Prod. (Cords)	-	967	255	1,000	53,044	-	-	55,266	3,230
Total Sawtimber	434	11,012	344	665	7,181	505	58	20,199	5,190
Total Other Prod.	-	7,903	490	1,214	53,994	-	-	63,601	5,190

Basic Requirements to Sustain Allowable Cuts

- (1) There must continue to be adequate fire control.
- (2) There must be adequate protection from insects and disease. Losses from these sources will tend to decrease in the future due to the prevention of damage and the salvaging of mortality.
- (3) One of the principal objectives of all phases of timber management, including access road plans, selection of sale areas, and silvicultural practices, must be to minimize losses and increase yields. In a large measure, this will be accomplished by cutting the stands or trees most in need of cutting.
- (4) The allowable cuts require that practically all of the nonreserved, commercial timber in the working circle must be accessible, operable, and cut over during the first rotation. This will require an adequate access road system to serve every acre of commercial timber.
- (5) The allowable cuts are based on the utilization of wood of commercial kind, size, and quality to not less than the same standards of merchantability used in making the inventories on which the allowable cuts are based. All board foot volumes in this plan are based on log scale, Scribner rule, and trees 11.0 inches d. b. h. and larger. Lodgepole pine is based on cordwood merchantability standards.
- (6) The allowable cuts are also based on the principle of coordinated use, including adequate protection of soil and site.
- (7) In addition to the above, adequate provision must be made to restock lands cut over or otherwise in need of this treatment. There must be continued and increasing productivity of the land to furnish a continuous supply of timber for the first and succeeding rotations.

In case these requirements are not met, it may be necessary to reduce the allowable cuts. If they are fully met or exceeded, it may be practical to increase the allowable cut.

g. Cutting Budget

Cutting on the working circle is outlined in the five-year cutting plan. See appendix for Coordinated Annual Timber Harvest and Access Road Plan. The five-year cutting plan is revised annually and is designed to relate current demands with the over-all timber harvest for the working circle and the Helena National Forest.

7. SALES POLICY

Sell full allowable annual cut of all species insofar as markets and finances for sale preparation, administration, and roads will permit.

Each sale will be authorized only after methods of cutting and logging are prescribed which will preserve the residual growing timber, promote reproduction, obtain practical fire prevention, maintain favorable conditions of waterflow, and obtain as complete utilization of the timber as existing markets will permit.

a. Size of Sales

The size of the timber sales in the Lincoln Working Circle will be determined by the need to sell sufficient timber to amortize the access roads, the selling of natural logging chances as one unit, and the need to keep sales to a size which would insure competition. At the present time there isn't a processing plant for lodgepole pine. It may be necessary to make large timber sale offerings of lodgepole pine to establish a processing plant which would use lodgepole.

b. Merchantability and Utilization Specifications

Economic factors will be given consideration in arriving at fair utilization standards. These standards will vary for different species from year to year and from locality to locality. Whenever possible, standards that will give fuller utilization of the raw material will be adopted.

Merchantability standards as established for the region for saw logs are as follows:

Species & Product	Tree Specifications		Product Specifications		
	Units Per Trees	Length	DIB at Small End	Net Scale in Percent of Gross Scale	Minimum Net Scale
White Pine	1	8	7	33-1/3	20
Ponderosa Pine	1	8	8	33-1/3	20
Lodgepole Pine	1	8	6	33-1/3	20
Spruce	1	8	8	33-1/3	20
Larch, Douglas-fir	1	8	8	33-1/3	20
Hemlock, Grand fir and Cedar	1	8	8	33-1/3	20
Dead Timber	1	8	9	50	20

It is the regional policy to set merchantability specifications to include the foreseeable minimum sized trees or logs that can be economically utilized without loss by the average efficient operator. The established minimums are averages. They should be used as a guide and varied depending upon probable use, location, and silvicultural requirements.

c. Logging Methods

Tractor or jammer skidding and truck hauling have been the principal methods of logging. Sale contracts require that care be exercised to prevent excessive breakage of sawtimber and destruction to the residual stand through logging operations. Skid trails will be on gradients that will not produce excessive erosion. Skid trails will not be permitted in streambeds, and streambanks will be protected. Timber will not be felled or dragged across streams or streambeds, except in unusual circumstances. Logging debris will be kept out of streams. Any debris which collects in streams at road crossings shall be removed. Soil erosion prevention requirements are included in sale contracts. Where soil needs indicate more stringent requirements than standard soil erosion prevention requirements, such measures will be provided.

8. FOREST DEVELOPMENT

a. Transportation

(1) Present System - The Lincoln Working Circle is bisected in the Helena Block by U. S. 10 North, running in an east-west direction. The Lincoln Block is bisected by State Highway No. 20, running in an east-west direction. The transcontinental Northern Pacific Railroad bisects the Helena Block. There are suitable sidings for loading forest products at Avon, Elliston, and Blossburg. The closest access to the Milwaukee Railroad is at Garrison, which is 16 miles west of Avon by oiled highway. The Milwaukee Railroad also has a spur in the Blackfoot Valley 32 miles west of Lincoln.

The double-lane gravelled road from Avon to State Highway No. 20 north of Helmville provides a connecting road suitable for log haul along the western edge of the working circle. The county road from the upper part of the Blackfoot drainage over Flesher Pass and through the Helena Valley provides a means of transportation of forest products from the Lincoln Block to Helena.

(2) Utilization Road Needs - Feeding into these main arteries are 98.7 miles of graded and drained timber access roads. Feeding into the timber access roads and/or main arteries are 90.4 miles of existing primitive roads. The road plan for the working circle calls for construction of an additional 769.7 miles. This planned road system will provide primary access to practically all the saw log and pulpwood timber within the circle.

(a) Priorities - There is an access road program and plan for the working circle on file. The plan specifies standard location and length of each individual project. The cutting budget section of this plan includes a list of roads to be constructed during a five-year period. This plan will be revised each year in the same manner as the cutting budget.

(b) Policy - If funds are available, all land access roads will be constructed by Federal funds; land utilization roads will be constructed by the timber purchaser. If funds are not available, necessary roads may be constructed by the timber purchaser where practical. In either case, all roads will be constructed on location and to design standards approved for the region.

The securing of rights-of-way through private and State lands provides a difficult problem within the working circle. To avoid complications and any undue delay, rights-of-way will be obtained well in advance of advertising sales or preparing construction contracts.

(c) Program - The five-year coordinated timber harvest and access road plan in the appendix shows the roads needed during the next five-year period. This coordinated timber harvest and access road plan will be revised annually in accord with manual instructions.

The first six projects which should be given priority in this working circle for construction from Federal funds are as follows:

<u>Name of Road</u>	<u>Road No.</u>	<u>Mileage</u>	<u>Estimated Cost</u>
1. Landers Fork	627	2.5	\$ 50,000.00
2. Copper Creek	330	1.5	40,000.00
3. Liverpool	607	2.1	30,000.00
4. Sauerkraut	1,893	7.0	75,000.00
5. Little Blackfoot	227	3.0	64,000.00
6. Hogun	1,841	4.0	70,000.00

b. Planting

(1) Needs - Within the working circle there are 1,283 acres of Federal forest land that are classified as nonstocked due mainly to past fires. This acreage represents approximately 0.3 percent of the total timbered, commercial land. Planting or seeding is needed to return this land to full productivity for commercial timber and to aid in watershed management.

(2) Policy - Nonrestocking commercial and noncommercial forest areas will be planted with suitable species at a maximum rate consistent with funds made available for these purposes.

Suitable species will be regarded as those available which may reasonably be expected to mature into forest cover on the area planted.

It will be the policy to promptly plant timber sale areas where needed to fill in nonstocked areas where natural stocking is not expected within five years after cutting. Planting will also be used to improve stand composition, and K-V funds will be collected and used for such work to the extent feasible.

(3) Program - Until there is some assurance that Federal appropriated funds become available in sufficient amounts, there is little purpose in presenting a detailed planting schedule in this management plan, but this fact should not detract from efforts toward completing a master record of plantable areas as set forth above.

A current and cumulative record of plantable acreage will be maintained on the forest. A master record for the working circle will be set up under files maintained under proposed planting projects. The objective will be to build and maintain a complete file of all plantable areas, based on surveys, and keep the data up to date by current revisions as needed. Seasonal planting plans for the working circle will be made each year from the list of accrued projects and in order of priorities. Detailed information needed for the planting plan is listed in the regional planting manual.

c. Timber Stand Improvement

(1) Needs

(a) Mature Stands - Little cutting has taken place in the past. Approximately 5,190 acres of mature stands are scheduled for cutting each year. These mature stands characteristically have an understory of suppressed, diseased, and weed trees, which should be removed in order to insure the reestablishment of desirable species as soon after as possible. Since patch cutting methods are to be employed in these mature stands, the need for stand improvement work is particularly apparent.

(b) Immature Stands - About 26,355 acres of medium and well stocked seedlings are now in need of weedings, thinnings, or improvement cuttings. These immature stands should be treated now to obtain an optimum quality and maximum volume at harvest age. In addition to the foregoing, 8,065 acres of seedlings and saplings are poorly stocked. These understocked stands are in need of fill-in planting.

The inventory also shows that about 120,000 acres of the pole-sized stands are of less than rotation age. These young stands are characteristically composed of several species in heavy competition with each other. Improvement cuttings are needed in these stands to maximize quality and volume production.

In addition to the foregoing, the inventory shows that about 50 percent of the sawtimber stands are less than rotation age. A light sanitation and improvement cut is needed in these stands at as early a date as practicable. However, harvest cutting in mature stands should probably precede this type of cutting.

(2) Policy - All stand improvement measures will be performed in accordance with instructions in the regional Timber Stand Improvement Handbook. On timber sale areas, stand improvement funds will be collected in accordance with the K-V Act to insure proper reestablishment of these stands.

Under certain conditions, particularly in lodgepole pine and Douglas-fir, overstocking often becomes a major problem. Provision will be made to hold K-V funds sufficiently long (up to 15 years) to insure that at least one thinning can be made after the successful reestablishment of seedlings has been gained and the degree of stocking can be determined.

(3) Program - In immature stands, no timber stand improvement work seems possible under the present funds available to the region. However, if a program develops, thinnings, weedings, pruning, and improvement cuttings should be initiated as soon thereafter as possible and as speedily as conditions will permit.

Annually treat about 5,190 acres cut over. Generally this work will consist of disposing of the unmerchantable and unsalvable volume left on cutover areas and reproducing the cutover areas by natural means if possible. If natural means fail, the area will be planted.

d. Disease Control

(1) Problems

Dwarf mistletoe Infection

Dwarf mistletoe infection is found in Douglas-fir and lodgepole pine stands throughout the working circle. The severity is considered moderate. A field survey is now being made of this during the current field season, but some months may elapse before the results of this survey are known.

References indicate that the parasite is not a fast spreading disease as a general rule, but, nevertheless, over a period of years its damaging effect can be great.

Lodgepole Pine Blister Rust

There are three known diseases in the lodgepole pine stands in the working circle. They are: western gall rust, caused by *cronartium harknessii*; paint brush blister rust, caused by *C. filamentosum*; and comandra blister rust, caused by *C. comandrae*. These diseases are destructive to reproduction and, when mature trees are infected, they cause a defect in the wood. The flat surfaces caused by these diseases are an important loss when the lodgepole pine is used for lumber or poles. The cankers also provide a point of entry for various heart rots, particularly red rot. A weak spot in the stem of the tree also develops to make them more susceptible to breakage from wind and snow. The full extent of the *Cronartium* problem and the economic loss is not known at this time.

Wood Fungus Diseases

Locally, Douglas-fir, spruce, and ponderosa pine are not seriously infected with heart rots. However, lodgepole pine and alpine fir show considerable heart rot in the overmature stands. Much of this heart rot is thought to be caused by *fomes pini*.

(2) Policy - It will be the policy to maintain closed crowns and fully stocked timber stands to be harvested at rotation ages sufficiently short to minimize losses due to diseases.

Where dwarfmistletoe infected stands occur, clear cutting appears to be the most effective harvesting method at least cost. Clear-cut areas should be of a size that will reduce the amount of perimeter area exposed. Area size, however, will be determined also with regard to the needs of the site and soil requirements in each case.

To supplement disease control work on sale operations, K-V funds will be collected for these purposes.

(3) Program - Harvest cutting of mature and overmature stands as rapidly as sustained cutting will allow and placing this timber under management will go far in eliminating the present rate of disease loss.

A program requiring annual reporting of any disease threat and the occurrence of serious disease areas should be done as an actionable part of this plan.

Cooperation and close liaison with disease research should be closely maintained.

e. Insect Control

(1) Problems:

General - Timber stands on the Lincoln Working Circle have been relatively free of insect attack in the past. However, at the present time there is an epidemic of spruce budworm on most of the Lincoln Working Circle, and the Douglas-fir bark beetle attacks appear to be increasing.

Spruce Budworm - Spruce budworm (*Choristoneura fumiferana* (Clem)) is a definite threat to the Douglas-fir in the Lincoln Working Circle. In 1957, there were 120,000 acres infested by the insect. This has been increasing during recent years. No control work has been done as yet. Control measures are easily accomplished by the aerial spraying of DDT over the infested area. A control project will be initiated when deemed advisable if the cooperation from private landowners can be obtained. Spruce budworm surveys are conducted each summer to determine the infestation boundaries and intensity of the current epidemic within the Lincoln Working Circle.

Spruce Bark Beetle - Spruce bark beetle is present in the Lincoln Working Circle in the endemic stage. This bark beetle is capable of multiplying at a rapid rate and, therefore, a thorough check should be made to be conscious of any increase in the future. Its potentialities as a tree killer are greater than any other known bark beetle in this region. The seriousness of any threat of spruce bark beetle infestation in the working circle is tempered by the fact that there are only 6,152 acres of the spruce and that the majority of the type is broken up into scattered patches along stream bottoms.

Douglas-fir Bark Beetle - Douglas-fir bark beetle has not been epidemic on the forest in the past. However, during 1956 and 1957 many groups of trees were noticed being killed by the Douglas-fir bark beetle. It is felt that the Douglas-fir bark beetle is on the increase and could possibly cause serious mortality during the next few years. The spruce budworm attacks on the Douglas-fir have reduced the vigor of trees in many areas. These trees are probably more susceptible to attack by the Douglas-fir bark beetle than trees of normal vigor. This increases the likelihood of buildup of the spruce bark beetle. There is a possibility of indirect control by logging where a system of timber access roads has been developed. This fact emphasizes the need for more access roads.

Another means of indirect control is by the removal or treatment of windfalls prior to brood development. In case of extensive blowdown, prompt steps should be taken to control the spread of the beetle by killing the broods while they are in the windfalls and not waiting for the spread of the attack to adjacent green timber. The Douglas-fir should be carefully watched during the

next few years for a serious buildup of Douglas-fir bark beetle. The current accomplishment of slash disposal is necessary to prevent a buildup of the Douglas-fir beetle after logging; otherwise, logging operations can do as much or more harm than good.

Mountain Pine Beetle - There has been little infestation by the mountain pine beetle. The young age classes of the lodgepole pine have been a help in preventing a buildup of the mountain pine beetle.

Western Pine Beetle - Damage to the ponderosa pine by the western pine beetle has been spotty. Only individual trees or small groups have been attacked. On sale areas, high-risk trees should be marked for cutting, and provisions should be made to salvage all trees in nonsale areas where accessibility will permit. In case of epidemics, proper control measures should be taken to retard the spread.

Ips Beetle - Ips beetle attacks have been confined chiefly to patches of saplings and pole-size ponderosa pine trees in sale areas. Overmature trees on the verge of dying are subject to attack by the Ips. On logging areas where the tops of felled trees are adjacent to or within a sapling stand, the Ips do considerable damage to the young stands of ponderosa pine. The beetles spread from the tops to the young growth. Some of this mortality could be eliminated by prompt removal of slash after logging.

Spruce Mite - Spruce mite has shown up in several parts of the Helena National Forest in epidemic proportions during 1957. So far, there is no indication of spruce mite buildup on the Lincoln Working Circle, although it has been reported on the Lincoln District. Infestations on other parts of the Helena National Forest will be closely watched, and signs of increased spruce mite activity on the Lincoln Working Circle will be watched for during the next few years.

(2) Policy - Regional policy will be followed. This provides for constant vigilance and reporting of any threat of insect epidemics that will seriously affect the stands.

(3) Program - Vigilance will be maintained to observe specifically and to report any increased activity by insects.

Where major outbreaks are evident, control programs will be planned and carried out in keeping with research findings and funds provided for this purpose.

f. Animal Control

(1) Problems:

Big Game - The heaviest animal impact against our forest resource at present is big game damage. This is by browsing in seedling and small sapling stands--generally in Douglas-fir. In many areas, heavy browsing is apparent on seedling ponderosa pine. Several measures for control of big game populations are provided in the district wildlife plans. These involve cooperation with the State Fish and Game Department to extend seasons and special hunts.

Porcupines - The second most important impact is porcupines. Considerable damage is being done to timber on the working circle by porcupines. This is mainly in lodgepole and ponderosa pine stands and consists of girdling of sapling and young mature stands.

Beaver - On the Helena National Forest, management problems caused by beaver are minor. Beaver damage is confined to some flooding of timber-bearing stream bottoms and interfering with drainage structures, notably blocking culverts.

Small Rodents - The effect that squirrels, mice, and moles have on reproduction on this working circle is not known. With increase in management intensity, control programs may be favored for these small animals in areas of seeding or planting.

(2) Policy - Game management policy outlined in the district wildlife plan should be helpful in controlling big game population. Where successful control of big game is not gained in areas of critical regeneration problems, a fencing policy may be necessary.

The present beaver management policy of the State Game Department should bring adequate control of beaver.

Control policy for rodents may become particularly evident in cutover or immature stands as mature stands are harvested.

Porcupine control is needed. This will be effected by a kill-on-sight policy for all forest employees. Also, a policy to inform the public as to the damage caused by porcupines will be helpful.

(3) Program - A program of hunting for control of big game appears to be the most popular. If this proves unsuccessful as harvest cutting proceeds, a fencing program may become necessary in winter- and spring-game-use areas.

Where a rodent problem becomes evident, control programs will be initiated when justified.

Porcupine control can be accomplished through the use of poison salt blocks properly placed in strategic locations and by sponsoring sportsman club contests, in addition to the on-sight-kill program of employees.

g. Fire Control

(1) Problems - There have been no exceptionally large fires in the Lincoln Working Circle during the last 50 years. During the dry summer season, the forested areas of the Lincoln Working Circle become highly inflammable. The combination of forest litter and debris, resinous trees, and lightning storms during this dry period of the year provides a condition for easy starting and spread of fires. The normal high-risk period for fires occurs in the months of July, August, and September, with abnormal seasons starting in May and extending through October.

Sustained timber yield is directly related to adequate fire control. The Forest Service is responsible for protecting from fire the national-forest land contained in this working circle. Under present state law, all private forest lands in this working circle west of the Continental Divide are classified for fire protection, and the landowners are required to provide adequate fire protection. The private lands within the working circle west of the Continental Divide are protected by the Forest Service.

Private forest lands east of the Continental Divide have not been classified for fire protection and assessment purposes. Individual landowners may, however, enter into voluntary cooperative fire protection agreements with the Forest Service, and in this manner receive fire protection at a nominal cost.

Records indicate that fire control on the working circle has been satisfactory. With increased cutting and use of the forests made possible by more roads and increased populations, even more stringent fire control measures are anticipated in order that the sustained timber yield can be maintained.

An analysis of the fires occurring within the working circle during the past ten years was made. (See page 34) This analysis showed an average of 154 fires per year, with an average annual burned area of 21.3 acres. The per cent for burned area on the Helena National Forest is 0.13 percent. Actual burned area within the working circle from 1947 through 1957 was 0.0047 percent. This indicates a very satisfactory fire record for these ten years. Records are not available to give accurate accounts of fire occurrences during the 19th century. Present stands of timber on the East Fork of the Blackfoot, Upper Little Blackfoot, Spotted Dog, Hope Creek, and Dog Creek drainages reflect fires occurring late in this period. Some of these fires are attributed to early mining operations in this area.

(2) Policy - To reduce the fire hazard on sale areas, complete or partial disposal of logging slash is required. Regional instructions and standards will be followed. After disposal operation is completed, the fuel ratings shall not be greater than a medium-medium, or its equivalent of low-high or high-low. Strips of slash along both sides of roads through logging areas will be disposed of.

(3) Program - Because of the serious threat of large disastrous fires during critical fire seasons, it is paramount that the forest fire plan, indicating necessary prevention, presuppression, and suppression needs, be closely followed. Timber sale contracts now contain clauses specifying the fire protection requirements for the operator according to the regional standards and the State fire laws.

When partial slash disposal results in a fire hazard that is not adequately covered by the normal protection force and the fire control funds are not available for the essential additional protection, adequate slash disposal funds will be collected under sale contracts to provide the additional protection for the number of years required for nature to reduce the hazard to normal.

FIRE ANALYSIS FOR LINCOLN WORKING CIRCLE

HELENA NATIONAL FOREST

1947 thru 1957
MAN-CAUSED FIRES

Fire Size Class	Fuel Type					TOTAL
	Saw-timber	Pole Stands	Cut Over	Old Burns Nonstocked	Noncommercial	
Number of fires						
A	7	7	2	5	3	24
B	2	10	2		8	22
C		1(11 A)	1 (25 A)		2 (11 A) 2 (19 A)	4
D						
E						
Total	9	18	5	5	13	50
Total Acres Burned	6.7	41.7	31.2	.5	54.3	134.4

LIGHTNING-CAUSED FIRES

Fire Size Class	Fuel Type					TOTAL
	Saw-timber	Pole Stands	Cut Over	Old Burns Nonstocked	Noncommercial	
Number of fires						
A	36	39	5	4	4	88
B	3	8		2	2	15
C		1(25 A)				1
D						
E						
Total	39	48	5	6	6	104
Total Acres Burned	12.6	52.9	.5	6.4	6.4	78.8
GRAND TOTAL NO. FIRES	48	66	10	11	19	154
GRAND TOTAL ACRES BURNED	19.3	94.6	31.7	6.9	60.7	213.2

h. Acquisition

(1) Problem - Forest land acquisition is somewhat limited in this working circle. Until a detailed land-use plan for the area has been developed, the area that should be acquired is not known.

The problem of road right-of-way acquisition is serious in this area because of the extensive ownerships adjacent to the Lincoln Highway. The present right-of-way policy of the State of Montana works a handicap in developing intermingled national-forest areas or those lying behind the State lands.

As an example, during the years 1958-60, approximately twenty separate right-of-way deeds will have to be acquired for the projects listed under "Forest Development."

(2) Policy - It will be the policy to encourage land adjustment through the exchange procedure in accordance with regional policy where administration of national-forest areas will be benefitted.

Acquisition of road rights-of-way will be worked out to the fullest practical extent before roads and other developments are programmed.

(3) Program - The need for a detailed land-use plan is apparent so that land acquisition and right-of-way needs are known. Staffing for this work at the forest level and effective planning are the first needs to place any program in effect.

9. COOPERATION

a. With Other Federal Agencies

(1) Coordinate this plan with any agency which is or may become active within the working circle boundary.

(2) Close cooperation should be exercised in the management of intermingled public domain lands and national-forest lands in the vicinity of Nevada Mountain (SW exposure) and Arrastra Creek by the Bureau of Land Management and the Forest Service.

b. With State Agencies

Coordinate with the Montana State Forestry Department on protective measures, with the Montana Fish and Game Department on fish or wildlife problems, with the State Land Commission office on access road problems, and with other state agencies having projects within the working circle.

c. With Private Organizations

(1) Cooperate with local sportsmen's organizations on fish and game management and keep them informed on our program and activities.

- (2) Cooperate with recreational organizations by coordinating the timber and recreational programs.
- (3) Cooperate with local organizations and interested citizens on access road programs, and in creating and sustaining local industry.
- (4) Acquaint interested parties with Forest Service plans, practices, and policies.

E. SUPPORTING DATA

1. HISTORY

The diaries of the Lewis and Clark expedition relate a party led by Meriwether Lewis made its way up the Blackfoot River and over Lewis and Clark Pass in the year 1806. This was the first of many illustrious adventures to be made into this working circle by the white man. The discovery of gold during the 1860's made the first large attraction to settlers. Due to slow transportation facilities, communities sprang up around the promising ore discoveries.

In 1861, on Lincoln Gulch a community was started that furnished roots for the present town of Lincoln. Ophir City, Gould, and Bald Butte were other communities that flourished around the mining dredges and shafts. Due to a one-sided economy and inability to develop other industries, these settlements gave way to ghost towns where only a few people remain to extract the less spectacular fortunes left of the wealth that lured many people to the original buildup of the towns.

In 1883, the Northern Pacific completed a transcontinental railroad that passes through the Helena Block. This transportation facility boosted the area development.

In 1912, the Helena National Forest was proclaimed by President Taft. This included most of what is now the Helena Block of the working circle. The area north of the Blackfoot River was included in the Missoula National Forest when it was proclaimed on September 24, 1912, by President Taft. Until 1925 that portion of the Lincoln Working Circle lying generally south of the original Missoula Forest and north of the original Helena Forest was public domain. During that year (1925) it became a part of the national forest. Minor changes continued in administration boundaries until 1940, when the present boundaries of the Helena National Forest were agreed upon.

While the working circle was taking shape, mining and cattle grazing continued on the area without a full understanding of the land capabilities. As landowners and land administrators became more familiar with the potential of the area, land uses took on a more stable trend. On national forest land during the past 30 years, reductions in permitted grazing stock have amounted to as much as 50 percent for cattle and 65 percent for sheep. Mining operations within the national forest no longer present the fire hazards that once were common. Better location of roads on the national forest has aided in reducing the growing problem of erosion on watersheds. History shows a development pattern in the working circle that can be likened to human development--quite reckless or carefree in the younger stages but, with a few years toward maturity, a more serious and stable outlook developing, with the future in mind as well as the present.

2. PHYSIOGRAPHY

a. Topography

The major portion of the working circle lies on the western slope of the Rocky Mountains. The Blackfoot and the Little Blackfoot Rivers provide the chief drainage system for this area. They flow west into the Clark Fork, which in turn empties into the Columbia River.

The topography in all of this area is mountainous, with moderate to steep slopes, except for river bottoms and basins. Most of the working circle has been glaciated on at least two occasions. The upper Blackfoot Valley and the area to the north of it have been heavily glaciated by glaciers of the Wisconsin and pre-Wisconsin stage. Each glacial extension, or lobe, scoured the land, leaving rounded ridge tops, thin soils or no soils at all in some places, and large depositions of heterogenous material in depressions and valleys. On each occasion, as the glacial lobes retreated, huge volumes of water flowed southwestward and westward, following the Blackfoot drainage to the Columbia River system. Areas of extensive outwash gravel deposits are a result of this mass runoff.

Much of the working circle to the south of the Blackfoot River is unglaciated. In the lower elevations toward the western edge of the Helena National Forest, there are considerable outwash and areas of glacial drift. This is a result of a great piedmont glacier of the pre-Wisconsin time which occupied much of what is now the Nevada Valley. This is particularly noticeable in the Black Mountain area. From the base of Black Mountain, broad strips of smooth-surface, gravelly terraces slope westward like remnants of great alluvial fans.

In the upper drainages of the Little Blackfoot River, there are glacial drifts both east and west of the village of Elliston; the Little Blackfoot glacier which deposited this drift had its head at the Continental Divide, on or near Thunderbolt Mountain in what is now part of the Helena National Forest.

Elevations range from about 4,000 feet above sea level in the western Blackfoot Valley in the vicinity of Ovando to 9,390 in the Lincoln back country. Farming, as a rule, is not practiced too extensively on this working circle, largely due to altitude. Commercial forests grow at all elevations, up to about 8,000 feet. Most of the forests grown above that elevation are noncommercial.

b. Soils

Soils in glaciated portions of the working circle (primarily that section north of the Blackfoot River) are very variable in composition and depth. Most of the present soil found on these glaciated slopes has been built up from parent rock formations since glaciation. The alluvial deposits of glacial till found in the Blackfoot and Little Blackfoot basins are gravelly loam. In the Nevada basin, tertiary deposits probably extend throughout the basin under cover of glacial drift and alluvial gravel.

Over most of the unglaciated portions, soils have built up over a much longer period and are quite deep.

The parent materials for the soils on this working circle are mostly of the pre-Cambrian sedimentary Belt series intruded with granitic rocks of the boulder batholith.

c. Climate

The climate varies from moderate to severe, coinciding closely with differences in elevation. It is moderate on the lower slopes and river basins, and most severe at the higher altitudes. Temperatures over the forest average about 41° F. for the year, but the range of temperature varies widely from 101° F. to -51° F. The relation between severity of climate and changes in elevation is very pronounced.

Precipitation is seasonal and irregular in distribution over the forest. The average annual precipitation for the forest is about 20 inches, which is mostly in the form of snow, particularly at the higher altitudes. Snowfall is sufficiently heavy over most of the forest area to limit logging operations to about 7 months in the average year. The summers usually are moderate in temperature and dry. The fire season extends from about July 1 to early September.

3. ECONOMY

a. General

The local economy on and adjacent to the Lincoln Working Circle has not developed to its full potential. The major transportation routes which are necessary to make full use of the timber and recreational values of the area have only recently been completed. Lincoln has been a seasonal town, dependent on sawmills which have run only during the summer season and on tourists' visits only during the summer and fall months. The planned development and sale of national-forest timber will eventually bring a much more stable lumbering economy to Lincoln.

b. Population by Communities

<u>Town</u>	<u>Population</u>
Lincoln	600
Avon	200
Elliston	250
Helenville	175

c. Industries

In Powell County, agriculture is the main industry, with lumbering, recreation, and mining in descending importance. In Lewis and Clark County, agriculture is also the most important industry, with recreation, lumbering, and mining of importance.

4. OPERATION OF PLAN

a. Annual Plans

Using the management plan as a tool, annual or periodic plans will be made for the purpose of putting the plan to work on the ground. Access road development will be coordinated with the cutting budget. Timber survey and timber sales stem directly from the cutting budget. Annual plans will be made to coordinate these activities with the guiding principles set forth in the main plan.

Other annual plans of operation will include timber stand improvement plans and planting plans.

b. Control Records

Systematic records will be maintained on the products removed from the forest, budgeted cut and actual cut, plantations established, areas cut over, etc. These records will be kept in two forms--control and map records.

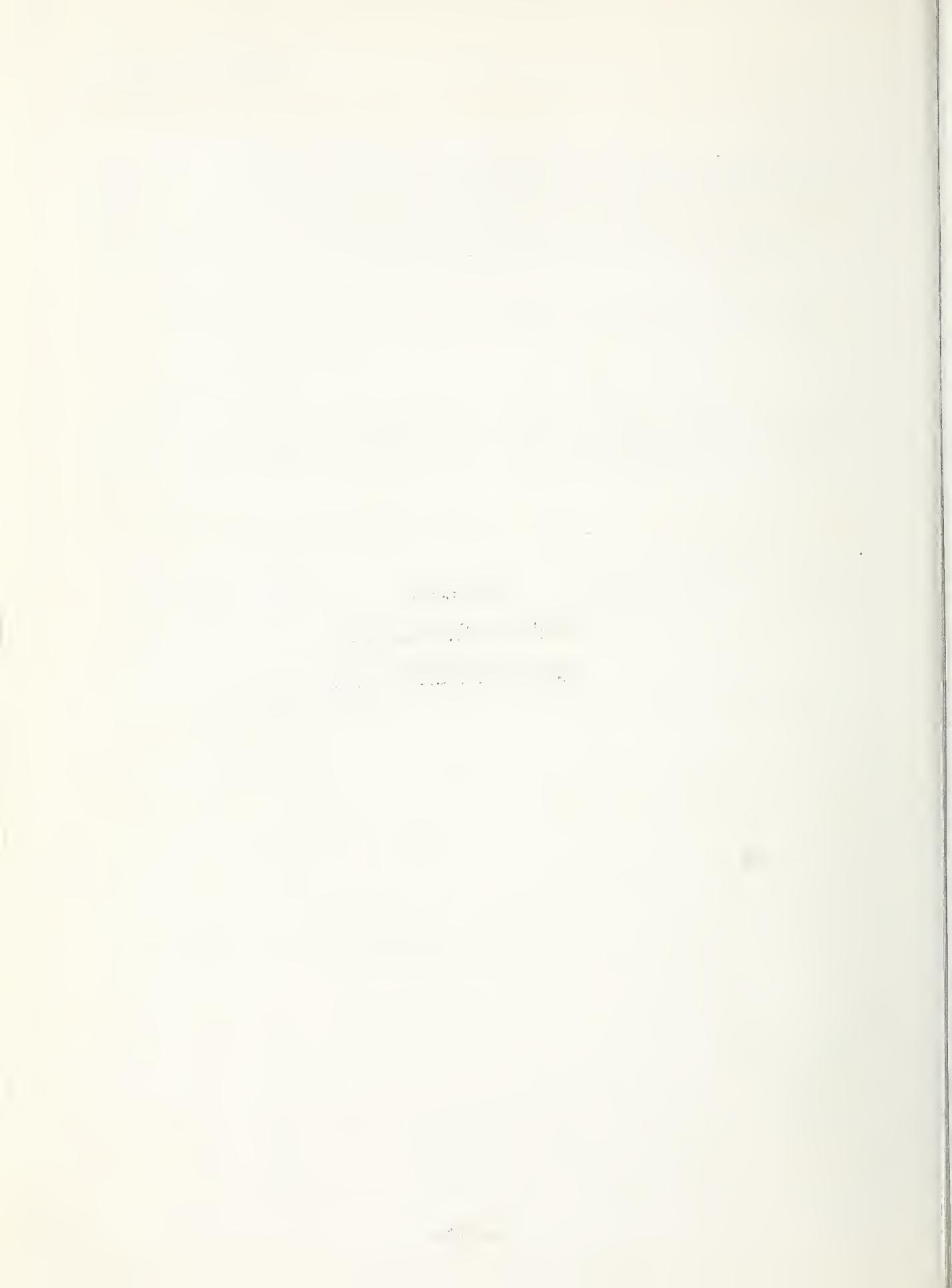
Records will consist of the following:

- (1) Sale of forest products will include: name of purchase, date, stumpage prices by species, the market supplied, kind of products, the location by compartment, and legal description.
- (2) Timber type and ownership map.
- (3) Map showing budgeted areas in accordance with a color code and legend scheme.
- (4) Sold area map.
- (5) Cutover area map.
- (6) Transportation plan map.
- (7) Planting map.
- (8) Timber stand improvement map.

APPENDIX

LINCOLN WORKING CIRCLE

TIMBER MANAGEMENT PLAN



Sampling error for the following stratification on the Lincoln Working Circle is as follows:

Sampling Error

<u>Strata</u>	<u>Percent</u>
D9W	16
D9M	5
LP8&9W	17
LP8&9M	12
LP8&9P	3
D8W	37

The Lincoln Working Circle has a cubic volume sampling error of plus or minus 5 percent (1 S.D.).

APPENDIX TABLE 1 - LAND AREA BY OWNERSHIP AND MAJOR CLASSES OF FOREST LAND

Class of Land	Ownership by Acres			
	National Forest	Private	Other Federal	Total
FOREST LAND				
Nonreserved				
Commercial	375,279	19,518	160	394,957
Noncommercial	8,708	306	--	9,014
Reserved				
Commercial				
Noncommercial				
TOTAL FOREST LAND	383,987	19,824	160	403,971
NONFOREST LAND				
Nonreserved	36,554	6,594	0	43,148
Reserved	--	--	--	--
TOTAL NONFOREST LAND	36,554	6,594	0	43,148
TOTAL LAND AREA	420,541	26,418	160	447,119

APPENDIX TABLE 2 - AREA TOTALS BY BLOCK, OWNERSHIP AND LAND CLASS
Area in Acres

Block	Ownership	Commercial	Non-commercial	Non-forest	Total
Lincoln	Natl. For.	293,694	6,884	25,003	325,581
	Other Fed.	160	0	0	160
	Private	9,765	148	1,397	11,310
	TOTAL	303,619	7,032	26,400	337,051

Helena	Natl. For.	81,585	1,824	11,551	94,960
	Other Fed.	0	0	0	0
	Private	9,753	158	5,197	15,108
	TOTAL	91,338	1,982	16,748	110,068
TOTAL - LINCOLN W. C.		394,957	9,014	43,148	447,119

APPENDIX TABLE 3 - COMMERCIAL FOREST AREA BY TYPES AND OWNERSHIP

Timber Type	Ownership by Acres			Total
	National Forest	Private	Other Federal	
Lodgepole Pine	207,205	8,872	72	216,149
Douglas-fir	157,593	10,308	88	167,989
Spruce	6,152	--	--	6,152
Ponderosa Pine	2,696	308	--	3,004
Larch	873	--	--	873
Alpine Fir	146	--	--	146
Spruce-Alpine Fir	116	13	--	129
Whitebark-Limber Pine	498	17	--	515
<hr/>				
Commercial Forest	375,279	19,518	160	394,957
Noncommercial Forest	8,708	306	--	9,014
Nonforest	36,554	6,594	--	43,148
<hr/>				
GRAND TOTAL	420,541	26,418	160	447,119

APPENDIX TABLE 4 - COMMERCIAL FOREST LAND BY OWNERSHIP,
TYPES, AND STAND-SIZE CLASS
Area in Acres

Type and Ownership Class	Sawtimber	Pole	Seedling & Sapling	Non- stocked	Total
<u>Lodgepole Pine</u>					
a. National Forest	11,493	161,217	33,334	1,161	207,205
b. Other Federal	0	57	15	0	72
c. Private	298	7,453	1,108	13	8,872
<u>TOTAL</u>	<u>11,791</u>	<u>168,727</u>	<u>34,457</u>	<u>1,174</u>	<u>216,149</u>
<u>Douglas-fir</u>					
a. National Forest	121,995	34,418	1,071	109	157,593
b. Other Federal	88	0	0	0	88
c. Private	7,849	2,459	0	0	10,308
<u>TOTAL</u>	<u>129,932</u>	<u>36,877</u>	<u>1,071</u>	<u>109</u>	<u>167,989</u>
<u>Spruce</u>					
a. National Forest	5,475	677	0	0	6,152
b. Other Federal	0	0	0	0	0
c. Private	0	0	0	0	0
<u>TOTAL</u>	<u>5,475</u>	<u>677</u>	<u>0</u>	<u>0</u>	<u>6,152</u>
<u>Ponderosa Pine</u>					
a. National Forest	2,675	21	0	0	2,696
b. Other Federal	0	0	0	0	0
c. Private	286	22	0	0	308
<u>TOTAL</u>	<u>2,961</u>	<u>43</u>	<u>0</u>	<u>0</u>	<u>3,004</u>
<u>Larch</u>					
a. National Forest	873	0	0	0	873
b. Other Federal	0	0	0	0	0
c. Private	0	0	0	0	0
<u>TOTAL</u>	<u>873</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>873</u>
<u>Alpine Fir</u>					
a. National Forest	131	0	15	0	146
b. Other Federal	0	0	0	0	0
c. Private	0	0	0	0	0
<u>TOTAL</u>	<u>131</u>	<u>0</u>	<u>15</u>	<u>0</u>	<u>146</u>
<u>Spruce-Alpine Fir</u>					
a. National Forest	78	38	0	0	116
b. Other Federal	0	0	0	0	0
c. Private	13	0	0	0	13
<u>TOTAL</u>	<u>91</u>	<u>38</u>	<u>0</u>	<u>0</u>	<u>129</u>
<u>Whitebark-Limber Pine</u>					
a. National Forest	197	301	0	0	498
b. Other Federal	0	0	0	0	0
c. Private	17	0	0	0	17
<u>TOTAL</u>	<u>214</u>	<u>301</u>	<u>0</u>	<u>0</u>	<u>515</u>
GRAND TOTAL	151,468	206,663	35,543	1,283	394,957

APPENDIX TABLE 5 - ACREAGE BY STRATA FOR NATIONAL FOREST LAND

Stocked	Non-stocked	Commer- cial	Noncom. Forest	Non- forest	Total Natl. Forest Land	
374,009	1,270	375,279	8,708	36,554	420,541	
Type & Crown Closure		Saw- timber	Pole	Seedling & Sapling	Non- stocked	Total
Lodgepole Pine	W	0	26,581	13,388		39,969
	M	7,256	106,630	12,570		126,456
	P	4,237	28,006	7,376		39,619
TOTAL		11,493	161,217	33,334	1,161	207,205
Douglas-fir	W	2,703	4,031	222		6,956
	M	88,845	16,873	175		105,893
	P	30,447	13,514	674		44,635
TOTAL		121,995	34,418	1,071	109	157,593
Spruce	W	0	29	0		29
	M	3,922	315	0		4,237
	P	1,553	333	0		1,886
TOTAL		5,475	677	0		6,152
Ponderosa Pine	W	0	21	0		21
	M	2,106	0	0		2,106
	P	569	0	0		569
TOTAL		2,675	21	0		2,696
Larch	W	0	0	0		0
	M	380	0	0		380
	P	493	0	0		493
TOTAL		873	0	0		873
Alpine Fir	W	0	0	0		0
	M	131	0	0		131
	P	0	0	15		15
TOTAL		131	0	15		146
Spruce-Alpine Fir	W	0	0	0		0
	M	0	0	0		0
	P	78	38	0		116
TOTAL		78	38	0		116
Whitebark- Limber Pine	W	0	0	0		0
	M	75	173	0		248
	P	122	128	0		250
TOTAL		197	301	0		498
GRAND TOTAL		142,917	196,672	34,420	1,270	375,279

APPENDIX TABLE 5a - AREA SUMMARY FOR PRIVATE LAND

Total Commercial	Total Noncommercial	Nonforest Land	Grand Total Area		
19,518	306	6,594	26,418		
Type & Crown Closure	Saw- timber	Pole	Seedling & Sapling	Total	Non- stocked
Lodgepole Pine	W 5 M 188 P 122	1,132 5,429 892	440 561 107	1,577 6,178 1,121	13
TOTAL	315	7,453	1,108	8,876	13
Douglas-fir	W 140 M 5,588 P 2,121	192 1,012 1,255	0 0 0	332 6,600 3,376	
TOTAL	7,849	2,459	0	10,308	
Ponderosa Pine	W 0 M 197 P 89	0 0 22	0 0 0	0 197 111	
TOTAL	286	22	0	308	
Spruce	W 0 M 0 P 13	0 0 0	0 0 0	0 0 13	
TOTAL	13	0	0	13	
GRAND TOTAL	8,463	9,934	1,108	19,505	13

APPENDIX TABLE 6 - TIMBER VOLUMES ON COMMERCIAL FOREST LAND

NATIONAL FOREST - NONRESERVED

Timber Type	Green Saw-timber Vol. 11.0 ^{1/2} dbh+ Scrib. Dec. C	Green Cubic Volume (M Cu. Ft.)			Dead Salvage Material 1/	Usable Volume from Green Cull Trees 1/
		Poles	Saw-timber	Total		
	M Ft. b.m.				Cords/A.	Cords/A.
Lodgepole Pine	333,412	266,778	81,907	348,685	189,652	72,784
Douglas-fir	790,048	64,284	172,218	236,502	156,511	66,452
Ponderosa Pine	16,229	1,024	3,298	4,322	3,244	812
E. Spruce	28,173	4,663	6,112	10,775	11,368	1,868
Larch	4,141	213	897	1,110	--	--
TOTAL	1,172,003	336,962	264,432	601,394	360,775	141,916

1/ Volumes for lodgepole pine include whitebark-limber pine.

Volumes for Douglas-fir include larch.

Volumes for Engelmann spruce include alpine fir.

Timber Type	Green Sawtimber Vol. 11.0 ^{1/2} + Scrib. Dec. C	Green Cubic Volume (M Cu. Ft.)		
		Poles	Sawtimber	Total
	M b.m.			
		<u>PRIVATE OWNERSHIP</u>		
Lodgepole Pine	14,617	12,585	3,592	16,177
Douglas-fir	50,189	4,101	10,936	15,037
Ponderosa Pine	1,717	114	348	462
Engelmann Spruce	35	--	--	--
TOTAL	66,558	16,800	14,876	31,676
<hr/>				
		<u>OTHER FEDERAL OWNERSHIP</u>		
Douglas-fir	537	33,360	116,388	149,748
Lodgepole Pine	92	103,968	22,629	126,597
TOTAL	629	137,328	139,017	276,345 or 276 M

APPENDIX TABLE 7 - BOARD-FOOT VOLUMES ON NONRESERVED NATIONAL FOREST LAND BY TYPE AND SPECIES

Acres	Timber Type	Thousands of Bd. Ft. - Net - Scribner Dec. C						Total
		Ponderosa Pine	Douglas-fir	Engelmann Spruce	Alpine Fir	Lodgepole Pine	Whitebark Limber Pine	
173,208	LP8&9	1,302	31,922	1,598	27,175	250,092	17,651	3,672
121,995	D9	16,309	683,606			39,739	1,157	
34,418	D8	1,084	43,831	1,243		3,079		
873	L9		336					3,805
5,684	S9		912	20,530	1,678	3,681	766	
715	S8			268	115	110	113	
2,675	P9		11,702			927		
21	P8		21	3,574				
				5				
339,589		30,418	764,186	23,639	28,968	297,628	19,687	3,672
								3,805
								1,172,003

APPENDIX TABLE 8 - NET VOLUME BY STRATIFICATION IN THOUSANDS OF BOARD FEET SCRIBNER NATIONAL FOREST LAND - NONRESERVED

Stratification		Ponderosa Pine	Douglas-fir	Engelmann Spruce	Alpine Fir	Lodgepole Pine	Whitebark Limber Pine	Aspen	Larch	Total
Acres										
LP8&9W	26,581	1,302	16,666	1,598	1,302	57,974	1,010			78,254
LP8&9M	114,134		9,245		20,772	141,526	10,500			183,641
LP8&9P	32,492		6,011		5,101	50,592	6,141			71,517
<u>Total</u>	<u>173,208</u>	<u>-</u>	<u>31,922</u>	<u>-</u>	<u>27,175</u>	<u>250,092</u>	<u>21,621</u>	<u>3,672</u>	<u>3,672</u>	<u>333,412</u>
D9W	2,703	<u>-</u>	23,340			2,625				26,230
D9M	88,845		13,060		577,937	32,517				623,514
D9P	30,447		2,984		82,329	4,527				91,067
Subtotal	121,995		16,309		683,606	39,739				740,811
D8W	4,031		1,084		12,625	472				14,181
D8M	16,873				19,016	1,080				20,096
D8P	13,514				12,190	1,527				14,960
Subtotal	34,418		1,064		43,831	3,079				49,237
<u>Total</u>	<u>156,413</u>	<u>-</u>	<u>17,292</u>	<u>-</u>	<u>727,427</u>	<u>42,818</u>	<u>-</u>	<u>1,157</u>	<u>1,157</u>	<u>790,048</u>
L9M	380				195					2,667
L9P	493				141					1,474
<u>Total</u>	<u>-</u>	<u>-</u>	<u>873</u>	<u>-</u>	<u>326</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>4,141</u>
S9W	0									
S9M	4,053				16,779	1,678	3,064	766		23,199
S9P	1,631				3,751	1,678	617			4,368
Subtotal	5,684				20,530	13	3,681			27,567
S8W							6			53
S8M	315		29		151	69	55	42		317
S8P			271		89	33	49	65		236
Subtotal			715		268	115	110	113		606
<u>Total</u>	<u>-</u>	<u>-</u>	<u>6,399</u>	<u>-</u>	<u>912</u>	<u>20,798</u>	<u>1,723</u>	<u>3,791</u>	<u>927</u>	<u>28,173</u>
P9M	2,106		9,477		3,033					13,437
P9P	569		2,225		541					2,766
Subtotal	2,675		11,702		3,574					16,203
P8W			21		21					26
<u>Total</u>	<u>-</u>	<u>-</u>	<u>2,696</u>	<u>-</u>	<u>3,579</u>	<u>-</u>	<u>927</u>	<u>-</u>	<u>927</u>	<u>16,229</u>
GRAND TOTAL	339,589		30,418		764,186	23,639	28,968	297,628	19,687	1,172,003

APPENDIX TABLE 9 - NET PARTIAL VOLUME, BY STRATIFICATION IN CUBIC FEET
NATIONAL FOREST

APPENDIX TABLE 9 (continued) - NET PARTIAL VOLUME BY STRATIFICATION IN CUBIC FEET
NATIONAL FOREST

Total this page

APPENDIX TABLE 9 (continued) - NET PARTIAL VOLUME BY STRATIFICATION IN CUBIC FEET
NATIONAL FOREST

APPENDIX TABLE 10 - STAND PER ACRE BY STRATIFICATION

- NATIONAL FOREST -

Stratification	Ponderosa Pine	Douglas-fir	Engelmann Spruce	Alpine Fir	Lodgepole Pine	Whitebark & Limber Pine	Aspen	Total
<u>Net Board Foot Volume Scribner</u>								
D9W	98	8,635						9,704
D9M	147	6,505						7,018
D9P	98	2,704						2,991
D8W	269							-
D8M		3,132						3,518
D8P		1,127						1,191
S9W		92						1,107
S9M								-
S9P								-
<u>Net Board Foot Volume Scribner</u>								
D9W	971							
D9M	366							
D9P	151							
D8W								
D8M								
D8P								
S9W								
S9M								
S9P								
<u>Net Board Foot Volume Scribner</u>								
S8W	960							
S8M	480							
S8P	240							
P9W								
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	3,910	950						
P9M	4,500	1,440						
P8W	1,000	240						
<u>Net Board Foot Volume Scribner</u>								
LP8&9W	49	627						
LP8&9M		81						
LP8&9P		185						
<u>Net Board Foot Volume Scribner</u>								
P9P	440							
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	49	182						
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	14	157						
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	14	157						
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	14	157						
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	14	157						
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	14	157						
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P9P	14	157						
P9M								
P8W								
<u>Net Board Foot Volume Scribner</u>								
P9P	14	157						

APPENDIX TABLE 10a - STAND PER ACRE BY STRATIFICATION
- NATIONAL FOREST -

Strata	Size	Net Partial Cubic Foot Volume Per Acre				Total
		Ponderosa Pine	Douglas-fir	Engelmann Spruce	Alpine Fir	
D9M	Saw Pole	19	2,215		244	2,478
D9M	Total	19	487		202	689
D9M	Saw Pole	29	2,702		446	3,167
D9M	Total	29	1,400		92	1,521
D9P	Saw Pole	19	1,831		39	470
D9P	Total	19	582		131	1,991
D8M	Saw Pole	50	50		38	648
D8M	Total	19	632		20	70
D8M	Saw Pole	53	674		58	718
D8M	Total	53	461		29	756
D8M	Saw Pole	242	461		201	662
D8P	Total	242	485		230	1,418
D8P	Saw Pole	727	485		16	258
D8P	Total	727	194		191	676
D8P	Saw Pole	194	19		207	934
D8P	Total	194	300		28	241
S9M	Saw Pole	19	146		58	330
S9M	Total	19	2,400		285	571
S9M	Saw Pole	20	200		300	2,831
S9M	Total	20	2,600		585	570
S9P	Saw Pole	48	864		190	3,401
S9P	Total	48	50		47	1,244
S8W	Saw Pole	98	1,164		300	840
S8W	Total	98	480		395	2,084
S8W	Saw Pole	100	100		200	575
S8W	Total	100	580		295	300
S8W	Saw Pole	200	200		50	875
S8W	Total	200	1,000		110	370
S8W	Saw Pole	1,200	1,200		210	1,630
S8W	Total	1,200	1,200		550	2,000

APPENDIX TABLE 10a (continued) - STAND PER ACRE BY STRATIFICATION
- NATIONAL FOREST -

Strata	Size	Ponderosa	Douglas-fir	Engelmann Spruce	Alpine Fir	Lodgepole Pine	Whitebark & Limber Pine	Aspen	Total
		Pine							
S8M	Saw				100	50	40	30	220
	Pole				800	50	400	30	1,280
-S8P-	Total				900	100	440	60	1,500
	Saw				50	20	30	40	140
	Pole				500	20	300	40	860
-P9M-	Total				520	40	320	80	1,000
	Saw				900	300	320	100	1,300
	Pole				200	100	100	100	400
-P9P-	Total				1,100	400	200	200	1,700
	Saw				776	200	200	200	976
	Pole				100	200	200	200	300
-P8M-	Total				876	400	400	400	1,276
	Saw				200	50	50	50	250
	Pole				250	50	50	50	350
-P8&9W	Total				450	100	135	11	600
	Saw				10				713
	Pole				85				1,663
-P8&9M	Total				10	220	3	52	2,376
	Saw					17		42	312
	Pole					18	10	20	1,824
-P8&9P	Total					35	13	62	2,221
	Saw					40		36	543
	Pole					10		47	443
	Total					50		83	986
								48	28

APPENDIX TABLE 11 - SALVAGE AND USABLE CULL VOLUMES BY TYPE STRATA

Type Strata	Salvage Cords/Acre	Usable Cull Cords/Acre
P9M	1	.3
P9P	2	.3
D9W	2	.2
D9M	1	.6
D9P	2	.4
S9W	2	.2
S9M	2	.3
S9P	2	.4
LP8W	1	.2
LP8M	1	.5
LP8P	2	.5

APPENDIX TABLE 12 - PERIODIC ANNUAL GROWTH AND MORTALITY DATA

FOR POLE AND SAWTIMBER STANDS, AS DETERMINED FROM FIELD SAMPLE

Type Strata	Growth	Mortality
	Per Acre Per Year Cu. Ft.	Per Acre Per Year Cu. Ft.
D9W	41.08	9.66
D9M	40.92	1.81
D9P	19.4	5.35
-----	-----	-----
D8W	56.29	6.63
D8M	23.47	0.14
D8P	23.65	12.80
Av. DF type	36.2	7.0
-----	-----	-----
LP9M	41.7	2.30
LP9P	34.6	11.80
-----	-----	-----
LP8W	37.9	2.41
LP8M	41.64	17.83
LP8P	8.45	—
Av. LPP type	37.8	5.6
-----	-----	-----
AF8W	29.22	—
AF8P	16.32	—
Av. AF type	22.8	—

APPENDIX TABLE 13 - CALCULATION OF ALLOWABLE CUT - PONDEROSA PINE TYPE
KEMP FORMULA

Site IV
Rotation 1/40

AC = Area to be cut annually x ave. stand per acre

$$AC = \frac{(A + 3AS + 5AP + 7AT)}{4R} \times (VA)$$

$$A - \text{Acres of restocking} \times \frac{1}{4R} = \frac{1}{560} \times 0 = 0$$

$$AS - \text{Acres of seedlings and saplings} \times \frac{3}{4R} = \frac{3}{560} \times 0 = 0$$

$$AP - \text{Acres of poles} \times \frac{5}{4R} = \frac{5}{560} \times 21 = (.0089)(21) = 1$$

$$AT - \text{Acres of sawtimber} \times \frac{7}{4R} = \frac{7}{560} \times 2675 = (.0125)(2675) = 33.4$$

Area to be cut annually = 33.4 + 1 = 34 acres per year

Ave. Stand Per Acre:

Type Strata	Acres	Net Volume M b.m.			Total
		Ponderosa Pine	Douglas-fir	Lodgepole Pine	
P9W	0				
P9M	2,106	9,477	3,033	927	13,437
P9P	<u>569</u>	<u>2,225</u>	<u>541</u>	—	<u>2,266</u>
Total	2,675	11,702	3,574	927	16,203
Weighted Stand/Acre		4.37 M	1.34 M	.35	6.06
Acres to Cut		<u>34</u>	<u>34</u>	<u>34</u>	<u>34</u>
Allowable Cut		148	46	12	206

APPENDIX TABLE 13 (continued)

PONDEROSA PINE TYPE - OTHER PRODUCTS - KEMP FORMULA

AC = (Area to cut) (Ave. stand per acre) = Area to cut = 34 acres

Type Strata	Acres	Net Cubic Volume 5" to 11"			Total
		PP	DF	LPP	
P9M	2,106	421*	211	211	849
P9P	569	57*	114	-	171
P8W	<u>21</u>	<u>5*</u>	<u>1</u>	<u>1</u>	<u>7</u>
	2,696	483	326	212	1,021
Ave. Stand/Acre (M Cu. Ft.)	(.18)		.12	.08	.20
Acres to Cut	(No Cut)		34	34	34
Allowable Cut (M Cu. Ft.)			4.1	2.7	6.8
Allowable Cut (Cords)			45	30	75

*Not considered in cut.

APPENDIX TABLE 13 (continued)

PONDEROSA PINE TYPE

AUSTRIAN FORMULA

$$\frac{Ga - Gd}{R} + I$$

Site V
Rotation 140

Ga = Actual growing stock = 16,229 M b.m.

Gd = Desirable growing stock

I = Increment

Site set at 75% V and 25% IV

Site IV 231 M.A.I. x 25% = 58

Site V 124 M.A.I. x 75% = 93

151 ft. b.m./acre M.A.I. fully stocked

49% = stocking

74 ft. b.m./acre M.A.I. on W.C.

I = (M.A.I.) (Commercial area) = 74 x 2696 = 199,504

Gd: Site IV 32,400 x 25% = 8,100 ft. b.m./acre fully stocked

Site V 17,300 x 75% = 12,975 ft. b.m./acre fully stocked

21,075 ft. b.m./acre fully stocked

21,075 Fully stocked

70% Attainable

14,753 Ft. b.m./acre

x 2696 Acres

39,774 M b.m.

25% = Percent of growing stock that is sawtimber size

9,944 M b.m.

AC = $\frac{Ca - Cd}{R} + I = \frac{16,229 M - 9,944 M}{140} + 200 M = 245 M$ b.m. per year

APPENDIX TABLE 13 (continued)

PONDEROSA PINE TYPE

HANZLIK FORMULA

$$\frac{V_m}{R} \neq I$$

Site V (75%), Site IV (25%)
Rotation 140

V_m = Volume in present stand = 16,229 M

R = 140

I = Site IV 231 25% = 58
Site V 124 75% = 93

151 ft. b.m./acre M.A.I. fully stocked

151 = Weighted M.A.I. for fully stocked stands

49% = Average stocking on ponderosa pine site

74 ft. b.m. = Net M.A.I.

Acres of mature = 2,675 acres

20% of poles and better stands are less than rotation

20% x 2675 = 535

21 Acres of seedlings, saplings and poles

556 Acres of growing stock

74 Bd. ft. = M.A.I.

41,144 = Increment on immature stands

$AC = \frac{V_m}{R} \neq I = 116 \neq 41 = 157$ M b.m.

APPENDIX TABLE 13 (continued) - CALCULATION OF ALLOWABLE CUT

DOUGLAS-FIR TYPE (LARCH, SPRUCE, ALPINE FIR AND SPRUCE-ALPINE FIR)
KEMP FORMULA

Site Poor
Rotation 140

AC = Area to be cut annually x Ave. stand per acre

$$AC = \frac{(A + 3AS + 5AP + 7AT)}{4R} \times (VA)$$

$$A = \text{Acres of restocking} \times \frac{1}{4R} = \frac{1}{560} A$$

$$AS = \text{Acres of seedlings and saplings} \times \frac{3}{4R} = \frac{3}{560} AS$$

$$AP = \text{Acres of poles} \times \frac{5}{4R} = \frac{5}{560} AP$$

$$AT = \text{Acres of sawtimber} \times \frac{7}{4R} = \frac{7}{560} AT$$

VA = Ave. stand per acre

R = Rotation = 140 years

Acres to be cut annually:

Type (Summary)	Sawtimber	Poles	Seedlings & Saplings	Restock	Total
D	121,995	34,418	1,071	109	157,593
S	5,475	677			6,152
L	873				873
AF	131		15		146
S-AF	78		36		116
Total	128,552	35,095	1,124	109	164,880
Area factors	.0125	.0089	.0054	.0018	
Area credits	1607	313	6		1,926
					Acres to cut annually.

APPENDIX TABLE 13 (continued)

DOUGLAS-FIR TYPE

Calculation of Average Stand Per Acre (Sawtimber)

Type Strata	Acres	Volume (M b.m.) by Species							Total
		P	D	S	AF	LP	WLP	L	
D9W	2,703	265	23,340			2,625			26,230
D9M	88,845	13,060	577,937			32,517			623,514
D9P	30,447	2,984	82,329			4,597	1,157		91,067
S9M	4,053		912	16,779	1,678	3,064	766		23,199
S9P	1,631			3,751		617			4,368
L9M	380		195					2,472	2,667
L9P	493		141					1,333	1,474
Total	128,552	16,309	684,854	20,530	1,678	43,420	1,923	3,805	772,519
Wtd. Ave. Stand per Acre (MBM)		.13	5.33	.16	.01	.34	.02	.03	6.02
Acres to Cut Annually		1,926	1,926	1,926	1,926	1,926	1,926	1,926	1,926
Annual Cut by Species (MBM)	250	10,266	308	19	655	39	58		11,595

SUMMARY FOR DOUGLAS-FIR TYPE SAWTIMBER

	Ponderosa Pine	Douglas-fir	Lodgepole Pine	Total
Ave. Stand Per Acre (MBM)	.13	5.53	.36	6.02
Acres to Cut	1,926	1,926	1,926	1,926
Annual Cut Sawtimber (MBM)	250	10,652	693	11,595

APPENDIX TABLE 13 (continued)

DOUGLAS-FIR TYPE

Calculation of Average Stand Per Acre (Other Products)

Type Strata	Acres	Ave. M Cubic Vol. of Pole-Sized Material in Mixed Type						Total
		DF	S	AF	LPP	WLP	L	
		M Cubic Feet						
D9W	2,703	1,316			546			1,862
D9M	88,845	38,292			3,465			41,757
D9P	30,447	1,522			609			2,131
S9M	4,053	203	1,216	1,216	567	203		3,405
S9P	1,631		163		326			489
L9M	380	15					164	179
L9P	493	10	—	—	—	—	25	35
Total	128,552	41,358	1,379	1,216	5,513	203	189	49,858
Ave. Cu. Ft./Acre		322	11	10	43	0	0	386
Acres to Cut		1,926	1,926	1,926	1,926			1,926
Total Cut of Other Products (Cu. Ft.)	620,172	21,186	19,260	82,818				743,436
Total Cut of Other Products (Cords)	6,891	235	214	920				8,260

APPENDIX TABLE 13 (continued)

DOUGLAS-FIR TYPE

AUSTRIAN FORMULA

$$AC = I \pm \frac{Vm - Vd}{R}$$

$$I = 55 \times 158,466 = 8,715,630 = 8,715 \text{ M b.m.}$$

Computation for Vd:

POOR SITE

<u>Age</u>	<u>Normal Yield</u>	
	<u>5%+</u>	<u>11%+</u>
20	—	—
40	670	—
60	4690	—
80	9100	—
100	13210	430
120	16620	1450
140	<u>9750</u>	<u>1450</u>
	70360 bd. ft.	3330 bd. ft.

$$70\% \times 70360 = 49,252 \text{ bd. ft.}$$

$$49.252 \times 20 \text{ (age class interval)} = 985 \text{ M b.m./Acre}$$

$$985 \text{ M b.m.} \div \text{Rotation (140)} = 7. \text{ M b.m./Acre}$$

$$7 \text{ M b.m.} \times \text{Total Com. Area (158,466)} = 1,109,262 \text{ M b.m.}$$

$$70\% \times 3330 = 2331.0$$

$$2331.0 \times 20 = 46620 = 46.6 \text{ M b.m./Acre}$$

$$46.6 \div \text{Rotation of 140} = .330 \text{ M b.m./Acre}$$

$$.33 \text{ M b.m.} \times 158,466 = 522,938 \text{ M b.m.}$$

$$Vm = \text{Total volume in present stand (this should go to 5% but volume table has only 11%)} = 794,189 \text{ M b.m.}$$

$$AC = 8715 \text{ M b.m.} \pm \frac{794,189 - 522,938}{140} = 8715 \pm 1,937 \text{ M b.m.} = 10,652 \text{ M b.m.}$$

APPENDIX TABLE 13 (continued)

DOUGLAS-FIR TYPE

HANZLIK FORMULA

$$AC = \frac{Vm}{R} + I$$

Site Poor
Rotation 140

Vm = Volume in present stand = 822,362 M b.m.

R = 140 years

I = Net annual increment on immature stands

93 = M.A.I. from fully stocked Poor Site

95% = Area in poor site

88

235 = M.A.I. fully stocked Medium Site

5% = Area in medium site

11.75

88 + 12 = 100 = Wtd. M.A.I. from fully stocked for 95% Poor & 5% Med. Site

Ave. stocking = 41%

41% x 100 = 41 bd. ft. per acre M.A.I.

Acres mature = 128,552

75% of poles and better stands in less than rotation age:

75% x 128,552 = 96,414 Acres

36,219 Acres of poles + seedlings and saplings

132,633 Acres of growing stock
41 Bd. ft. per acre (M.A.I.)

5,438 M b.m. increment per year in immature stands.

$AC = \frac{Vm}{R} + I = 5,874 + 5,438 = 11,312$ M b.m.

APPENDIX TABLE 13 (continued) - CALCULATION OF ALLOWABLE CUT

LODGEPOLE PINE TYPE (LODGEPOLE, WHITEBARK-LIMBER PINE)
KEMP FORMULA

Site Poor
 Rotation 100

AC = Area to be cut annually x average stand per acre

$$AC = \lceil .0033(A) + .01(AS) + .0167(AP + AT) \rceil^* \times AV$$

A = Acres restocking

AS = Acres of seedlings and saplings

AP & AT = Acres of poles and better

Acres to cut annually:

Type (Summary)	Poles & Better	Seedlings & Saplings	Restock	Total
LPP	161,217 11,493	33,334	1,161	207,205
WLP	301 197			498
Total	173,208	33,334	1,161	207,703
Multipliers	.0167	.01	.0033	
Acres to be cut	2,893	333	4	3,230

* Multipliers for Kemp formula with 3 stand-size classes for 100-year rotation.

APPENDIX TABLE 13 (continued)

LODGEPOLE PINE TYPE

Calculation of Average Stand Per Acre (Sawtimber)

Type Strata	Acres	Volume (M Cubic Feet)						Total
		P	DF	S	AF	LPP	WLP	
LP8&9W	26,581	266	3,588		292	14,566	239	18,951
LP8&9M	114,134		1,940	342	4,794	35,610	2,625	45,311
LP8&9P	32,493		1,300		1,170	12,704	1,560	16,734
Total	173,208	266	6,828	342	6,256	62,880	4,424	20,996
Ave. Vol./Acre		2	39	2	36	363	26	468
Acres to Cut Annually		3,230	3,230	3,230	3,230	3,230	3,230	3,230
Total Cubic Feet Cut		6,460	125,970	6,460	116,280	1,172,490	83,980	1,511,640
Total Cords (+ 90)		72	13.99	72	1,292	13,028	933	16,796
Allowable Annual Cut		36	700	36	646	6,514	466	8,398 M b.m.
				1,382 DF			6,980	

Calculation of Average Stand Per Acre (Other Products)

Type Strata	Acres	Volume (M Cubic Feet)						Total
		P	DF	S	AF	LPP	WLP	
LP8&9W	26,581		2,259		1,116	40,830		44,205
LP3&9M	114,134		2,054	1,141	2,283	202,703		208,181
LP8&9P	32,493		325		1,527	12,542		14,394
Total	173,208		4,638	1,141	4,926	256,075		266,780
Ave. Vol./Acre (Cu. Ft.)			27	7	28	1,478		1,540
Acres to Cut			3,230	3,230	3,230	3,230		3,230
Total Cu. Ft. Cut			87	23	90	4,774		4,974
Total Cords (+ 90)			967	255	1,000	53,044		55,266

APPENDIX TABLE 13 (continued)

LODGEPOLE PINE TYPE

AUSTRIAN FORMULA

$$AC = I \pm \frac{Vm - Vd}{R}$$

$I = 20$ cu. ft. (present average annual increment per acre for lodgepole pine type) $\times 207,703$ acres (commercial forest area) = $4,154,060$ or $4,154$ M cubic feet

$Vm = 348,537$ M cubic feet

Computation for Vd :

POOR SITE

<u>Age</u>	<u>Normal Yield</u>
20	—
40	200
60	1220
80	2350
100 ($\frac{1}{2}$)	<u>1615</u>
	5385

$$5385 \times 80 = 4308 \text{ cubic feet}$$

$$4308 \times 20 = 86,160 \text{ cubic feet}$$

$$86,160 \div 100 = 862 \text{ cubic feet per acre}$$

$207,703 \times 862 = 179,039,986$ or $179,040$ M cubic feet realizable growing stock.

$$AC = 4,154 \text{ M} \pm \frac{348,537 \text{ M} - 179,040 \text{ M}}{100} = 4,154 \pm \frac{169,533}{100} = 4,154 \pm 1695$$

$\approx 5,849$ M cubic feet, or $24,566$ M b.m. or $64,988$ cords

VON MANTEL FORMULA

$$AC = \frac{Vm}{\frac{1}{2}R} = \frac{348,537}{\frac{1}{2} \times 100} = \frac{348,537}{50} = 6,971 \text{ M cubic feet or } 29,278 \text{ M b.m.}$$

HANZLIK FORMULA

$$AC = \frac{Vm}{R} \neq I$$

Computation for I = Growth on immature stands:

$$34,495 \times 20 \approx 689,900 \text{ cubic feet or } 690 \text{ M cubic feet}$$

$$AC = \frac{348,537}{100} + 690 = 3,485 + 690 = 4,185 \text{ M cubic feet, or } 17,577 \text{ M b.m.}$$

COORDINATED ANNUAL TIME & HARVEST AND ACCESS AND PLAN

10

Location on map to be sold	Planned cut by fiscal years, 1961 and decimals	Estimated non-A.F. timber hauled by	Year Account	Amount and kind and cost of work done in thousand of dollars and revenue lost to date		Status of notes
				FY 1961	FY 1962	
Beaver-Mitsustra	6.60	1.61	1.62	1.65	1.64	
South Beaver	2.6	2.0				
Little Gulch	3.5	1.00				
Rosin Gulch	2.0	1.00				
Swanier Cr.	3.00	1.00				
Copper Cr.	11.00	2.00				
Copper Cr.	11.00	2.00				

② 9, 5

1774

THEOREM 1.1. $\mathcal{F}_{\text{REGA}} \text{ AND } \mathcal{I}_{\text{REGA}}$ are $\mathcal{L}_{\text{REGA}}$ - \mathcal{Y} - $\mathcal{S}/\mathcal{Z}/\mathcal{W}$ \mathcal{P} .

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TIMBER HARVEST PLAN

ACCESS ROAD PLAN

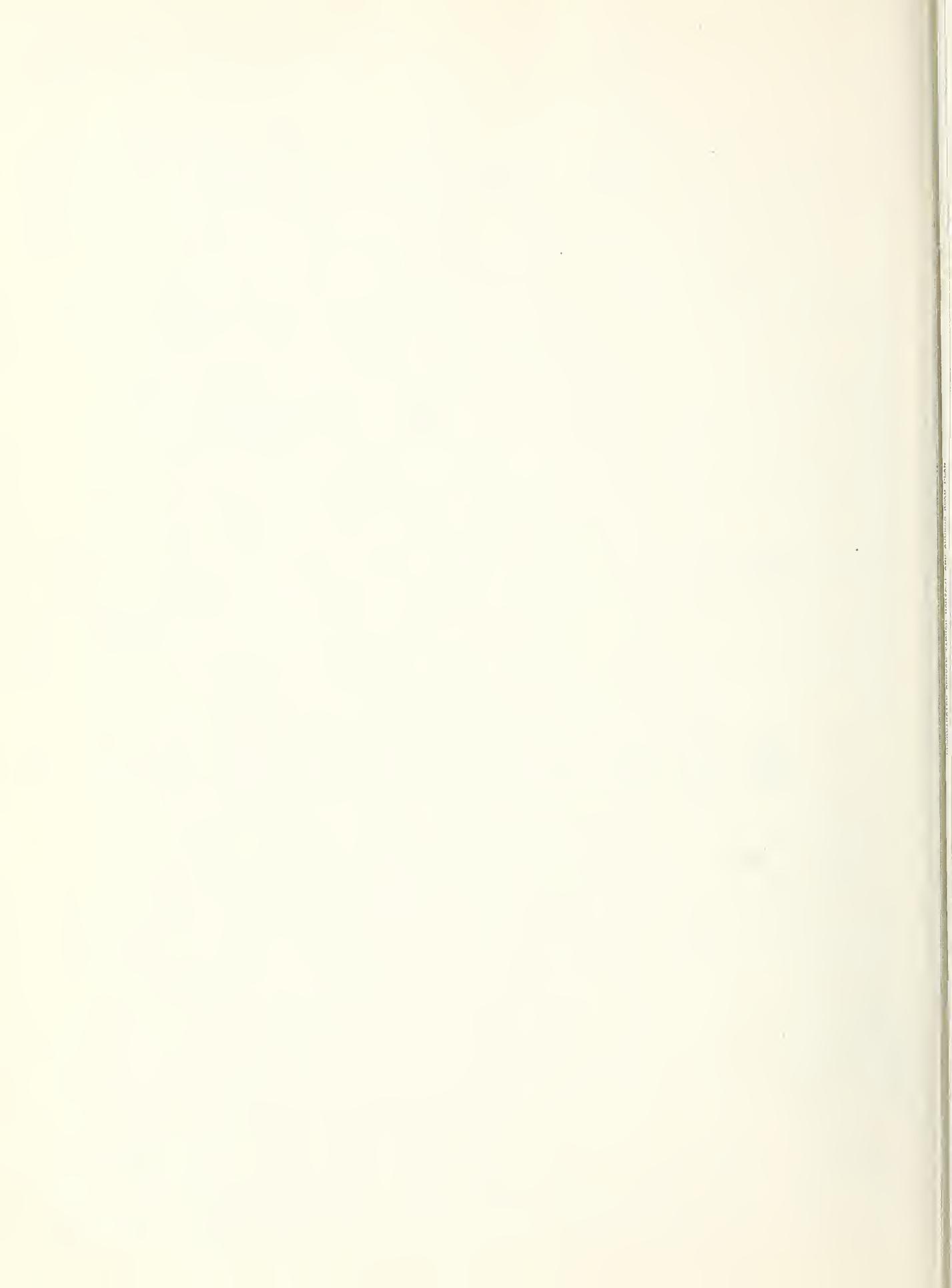
Note: If a sale requires the construction of more than one road or if one road serves more than one sale, use one horizontal space across the form for each sale or each road involved.

RENTA
Forest
"Forest circle" ^{allowable annual cut = 3%} ^{million board ft}

refer to Road Handbooks, page 6, Paragraphs 1 and 2, for definitions of "New Construction" and "Reconstruction."

Responsibility: Forest Service Operator Landowner Other _____

At first sight, the Y. RHOX west survivor line 5/2/



NUMBER 14

1000000000

ACCESS ROAD PLAN

Note: If a road requires the construction of more than one road or if one road serves more than one sale, use one horizontal space across the form for each sale or unit road involved.

Total cost must include all costs: engineering, grading, surfacing, and drainage facilities. Refer to form FS-118, line 20, column 2.

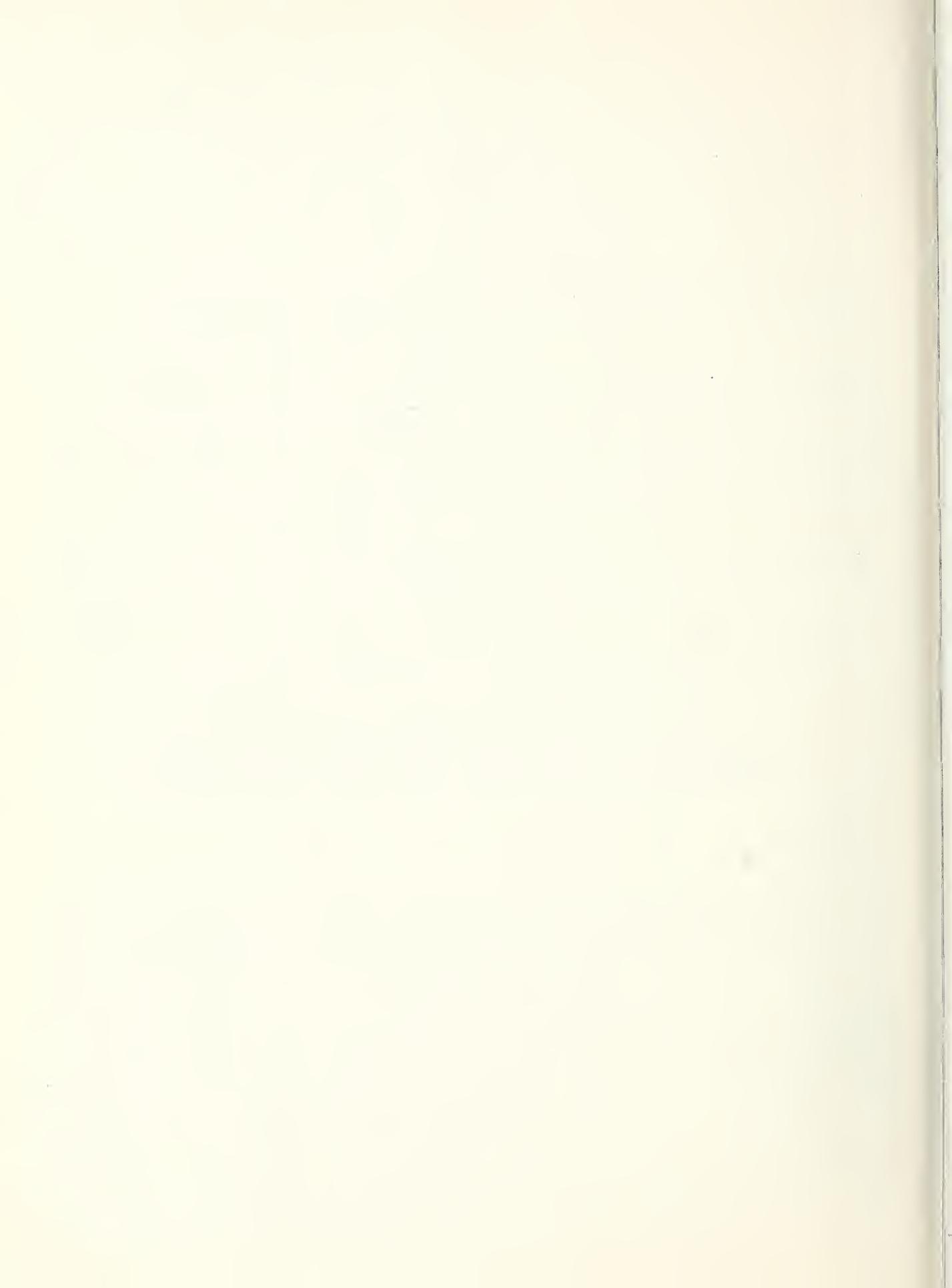
Refer to Road Handbo^k, page 16, paragraphs 1 and 2, for definitions of "new construction" and "reconstruction."

Total cost must include all costs; engineering, grading, surfacing, and drainage facilities. Refer to form FG-1B, line 20, column 2.

Refer to Read Handbook, page 63, paragraph 4 and 5, for definitions of "New construction" and "Reconstruction."

refer to Road Handbook, page 202, paragraph 4 and 5, for definitions of "New construction" and "Reconstruction."

of "new construction" and "reconstruction." A



The following from the original are not reproduced here:

Table showing Area Summary for Private Land

- " " Timber Volume on Private Commercial Forest Land
- " " Net Volume by Stratification in Thousands of Board Feet
- Scribner
- " " Net Partial Cubic Foot Volume by Stratification & Species
- in Thousands of Cubic Feet on Private Forest Land
- " " Stand per Acre by Stratification (Net Partial Cubic Feet
- Volume per Acre)

Growth-Age Relationship Curves

Map of Compartments

- " " Transportation
- " " Burned Area
- " " Fire Occurrence

Regional Marking Guides for Lodgepole Pine, Douglas-fir, Engelmann Spruce, Alpine Fir, and Ponderosa Pine



